Estimates of Snag Densities on east-side Forests in Region One of the Forest Service

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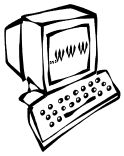
Region One Vegetation Classification, Mapping, Inventory and Analysis Report				$\bar{x} = \frac{\sum x}{n}$

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Estimates of Snag Densities For Eastside Forests in the Northern Region		

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1.0 Introduction

In 2000, the Northern Region Snag Management Protocol provided optional snag retention standards which were based on using FIA data from western Montana forests. However, the Protocol specifically recognized that FIA data from northern Idaho and eastern Montana was not used in the Protocol, as it was not available at the time. FIA data is now available and the data for the eastside Forests in this paper provides the most current snag data available. Table 1 shows snags per acre across the entire land base between the three geographic areas of the Region. There is a statistically significant difference in the density of snags and large-live trees between these areas due to biophysical and climatic differences between the areas. This suggests that snag analysis and management plans pertaining to snags should be formulated by geographic area and not extrapolated from one area to another. Furthermore, the 2000 Protocol specifically provided that when local data are available or are considered better than the sources used in the Protocol, Forests have the option to use those data sets. This report provides a replacement for the Northern Region Snag Protocol for eastside Montana forests in Region 1. The snag information provided in this paper does not set forth mandatory or required direction but rather provides current snag information and analysis for consideration by the Forests.

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Table 1: Estimates of snag and live tree densities and associated 90% confidence intervals, by diameter class, for Eastern Montana, Western Montana, and Idaho Forests in Region 1.

Area	Snags per Acre 15"+			Snags per Acre 20"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
Eastern Montana	2.2	1.9	2.5	0.5	0.4	0.6	11.2	10.4	12.1	2.7	2.4	3.0	1475	1175
Western Montana	2.9	2.6	3.2	0.9	0.8	1.1	14.8	13.9	15.6	4.6	4.3	5.0	1351	1243
Idaho	4.0	3.6	4.4	1.6	1.4	1.8	21.3	20.1	22.5	7.8	7.2	8.4	1057	1005

Region 1 completed this analysis related to snag densities for planning purposes and project-level retention and recruitment options for consideration, for Forests on the eastside of the Region; the Beaverhead-Deerlodge, Custer, Gallatin, Helena, and Lewis and Clark. It used Forest Inventory and Analysis (FIA) data to explore the density and distribution of snags within and outside of wilderness/roadless areas, by habitat type groups, dominance groups, and seral stages. This analysis took into consideration recent findings on the effect that timber harvest and human access have on snag density; how snag density relates to stand succession and disturbances; and the spatial pattern of snags.

The results of this analysis will enable the eastside forest of the Region to monitor snags over time at the broad-level and adaptively manage project-level considerations, as snag densities change over time.

2.0 Methods

2.1 Overview of data used in this analysis

Forest Inventory and Analysis (FIA) data were used to explore the distribution of snags on Forests in Region 1 east of the continental divide. Using FIA data to assess the density of snags allows for regional monitoring based on an unbiased, representative sample of forest lands subject to regular remeasurement. Many attributes are measured on an FIA plot, including habitat type and incidence of snags and their diameter at breast height (DBH). For an overview of FIA data in general and why it is appropriate to use in this analysis, see Appendix A.

The FIA sampling frame uniformly covers all forested lands, regardless of management emphasis; thus, wilderness and roadless areas, as well as actively managed lands, have equivalent sampling probabilities. As a result, spatial data sets can be intersected with FIA plot locations to estimate snag density for specified geographic areas.

2.2 Output displayed in tables

Estimates of mean snag density from FIA data are displayed with their respective 90% confidence intervals, which provide an indication of the reliability of the estimate. At a confidence level of 90%, unless a 1 in 10 chance has occurred, the true population mean is within this interval. Average densities per acre are shown for diameter classes: 10.0" DBH and larger, 15.0" DBH and larger, and 20.0" DBH and larger. It should be noted that these three classes are not mutually exclusive, all snags15.0" DBH and larger are included in the estimate of

snags 10.0” DBH and larger, and all snags 20.0” DBH and larger are included in the estimate of snags 15.0” DBH and larger.

The total primary sampling units (PSUs) are the number of FIA plots within the domain of interest, such as wilderness/roadless or with a specified dominance group. The number of forested PSUs are the number of FIA grid locations that have at least a portion of the PSU with a “forested” condition. The information from the “forested” portion of the PSUs are used in the analysis.

3.0 Preliminary analysis of snag densities on Eastside Forests

We evaluated snag densities on the eastside Forests of Region 1 using a hierarchical approach.

3.1 Comparison of Snag Density within and outside of Wilderness and Roadless Areas

First, we looked at the density of snags within and outside of wilderness and roadless areas. Timber harvest and human access can have substantial effects on snag density and longevity (Wisdom and Bate, 2008; Russell et al. 2006). Exploring the density of snags in wilderness and roadless areas can provide insight to natural snag abundance and distribution on a Forest. These can be compared to paired field plots outside wilderness/roadless to help to understand differences between areas that have been influenced by management and unmanaged areas. There is some uncertainty how climate, a period of cool and moderate precipitation, and fire suppression from 1930-1985 has affected snag density and distribution in wilderness and roadless areas. Harris (1999) notes similar uncertainty concerning effects of fire suppression on creation of snags in unharvested areas of western Montana. However, even with some degree of uncertainty it is the best quantitative data available to represent natural forested systems. To date, there has been no known extirpation of cavity nesting species from eastside Forests, within or outside of roaded areas. It follows that, in general, analysis of the roadless portion of these Forests will represent an appropriate range of snag numbers and distribution to develop desired snag conditions for planning purposes.

As shown by Table 2, there are fewer snags in each of the diameter classes outside of wilderness and roadless areas for the eastside, in general, and for all of the Forests except the Helena. Furthermore, the larger the snag, the less common it is. This is largely due to less trees living to an older age, as trees age, they grow slower, never reaching very-large diameters, and the inability of systems to contain large old trees and snags due to various types of disturbance agents which kill and remove them over time.

Table 2: Mean snag densities per acre with 90% confidence interval, by diameter classes, inside and outside of wilderness/roadless areas for all eastside Forests and for each Forest.

	Area	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	Eastside Forests	12.2	10.8	13.7	2.9	2.5	3.3	0.7	0.5	0.8	937	747
	Beaverhead Deerlodge	10.6	8.5	13.0	2.6	1.9	3.3	0.5	0.3	0.8	325	253
	Custer	12.7	7.0	19.4	3.8	1.8	6.2	1.0	0.4	1.6	84	44
	Gallatin	17.6	14.4	21.1	4.7	3.7	5.9	1.3	0.9	1.8	221	170
	Helena	10.1	5.9	15.0	0.9	0.3	1.6	0.2	0.0	0.4	85	79
	Lewis & Clark	10.3	7.7	13.2	2.2	1.5	3.1	0.4	0.2	0.7	222	201
Outside Wilderness / Roadless	Eastside Forests	4.4	3.5	5.3	1.1	0.8	1.4	0.2	0.1	0.3	538	428
	Beaverhead Deerlodge	2.9	1.9	4.0	0.7	0.4	1.0	0.2	0.1	0.3	222	189
	Custer	3.2	1.5	5.2	1.1	0.4	1.8	0.0	0.0	0.2	111	61
	Gallatin	7.4	4.2	11.0	2.5	1.2	3.9	0.4	0.1	0.9	64	53
	Helena	5.0	2.7	7.6	1.2	0.4	2.1	0.4	0.1	0.8	64	59
	Lewis & Clark	6.7	3.6	10.6	0.9	0.3	1.6	0.1	0.0	0.3	77	66

3.2 Estimates of Snag Density by Habitat Type Groups

Second, estimates of large-snag density, by aggregations of habitat types (Pfister, 1977), referred to as habitat type groups, commonly used for eastside vegetation assessments (Appendix B) were derived (Table 3). Each of these habitat type groups have similar biophysical and disturbance regime characteristics that determine snag abundance ranges during various stages of succession. Habitat type groups were used instead of Vegetative Response Units (VRUs) because habitat type groups are a consistent classification utilized across all eastside Forests for planning and analysis.

Within wilderness/roadless areas, some habitat type groups contain similar densities of large snags (e.g., warm and very dry, warm and dry). Habitat groups with similar snag densities are shaded in Table 3. Each of these shaded habitat type groups have characteristic disturbance regimes that are generally different between groups and contribute to snag abundance, during various stages of succession, in different ways. One of the differences is the numbers of snags produced. The warm groupings have fewer snags, most likely due to frequent, low- to mid-severity fire that tended to produce a relatively constant level of snags at low numbers. The cool group, with a characteristic fire regime that tended to have less frequent, but with more severe fires, produced pulses of snags, and generally a greater quantity of snags, especially early in the forest succession cycle. Then as stands aged, the density of snags increased, until another high-severity stand replacing fire occurs. The cold types tend to produce high snag densities as characteristic disturbance regimes produced persistent snags over a long periods due to colder climates, where decomposition rates are slower, and the period of time between stand replacing events were likely the longest. One again, we see that the larger the snag, the less common they are within the forest. Individual Forest's snag densities, by these habitat type groups are displayed in Appendix C, Table 1.

Table 3: Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by initial habitat type groups, for all eastside Forests.

Area	Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total # PSUs	# Forested PSUs
		Mean	90% CI Lower Bound	90% CI Upper Bound	Mean	90% CI Lower Bound	90% CI Upper Bound	Mean	90% CI Lower Bound	90%CI Upper Bound		
In Wilderness / Roadless	Warm & Very Dry	5.1	2.8	7.9	1.4	0.7	2.3	0.3	0.1	0.6	105	105
	Warm & Dry	5.8	1.8	10.9	1.4	0.5	2.6	0.3	0.0	0.6	44	44
	Warm & Moist	4.7	2.1	7.8	1.1	0.2	2.2	0.3	0.0	0.9	31	31
	Cool & Moist	12.2	7.6	17.5	2.5	1.0	4.3	0.5	0.1	1.0	68	68
	Cool & Dry to Moist	14.0	11.0	17.1	3.0	2.2	4.0	0.6	0.4	0.9	207	207
	Cool & Moist to Wet	16.2	9.8	23.6	2.6	1.3	4.3	0.5	0.1	0.9	36	36
	Warm to Cool & Dry	13.7	8.7	19.4	3.5	2.0	5.3	0.8	0.3	1.4	45	45
	Cool & Wet	18.3	12.0	25.1	5.5	3.2	8.2	1.5	0.5	2.9	39	39
	Cold & Dry to Wet	18.9	14.2	24.1	4.4	3.0	6.1	1.1	0.6	1.6	95	95
	Cold & Dry	11.5	6.8	16.9	3.3	2.0	4.6	1.1	0.6	1.6	60	60
Outside Wilderness / Roadless	Warm & Very Dry	2.0	1.2	3.1	0.8	0.4	1.2	0.2	0.0	0.3	124	124
	Warm & Dry	3.1	1.5	4.9	0.9	0.3	1.7	0.4	0.1	0.8	53	53
	Warm & Moist	2.5	0.8	4.5	0.4	0.0	1.0	0.2	0.0	0.5	39	39
	Cool & Moist	3.4	1.5	5.5	0.8	0.0	1.8	0.2	0.0	0.4	51	51
	Cool & Dry to Moist	5.2	3.1	7.5	0.8	0.3	1.5	0.1	0.0	0.3	97	97
	Cool & Moist to Wet	6.6	0.0	17.0	1.2	0.0	4.6	0.0	0.0	0.0	5	5
	Warm to Cool & Dry	12.5	6.1	20.0	3.2	1.3	5.6	0.9	0.1	2.0	19	19
	Cool & Wet	6.7	1.5	13.6	1.6	0.0	4.1	0.0	0.0	0.0	15	15
	Cold & Dry to Wet	16.6	5.9	30.4	4.0	1.4	7.0	0.4	0.0	1.1	15	15
	Cold & Dry	11.5	0.0	31.2	2.0	0.0	7.7	0.0	0.0	0.0	5	5

Third, after evaluating large-snag abundance (Table 3), productivity, and species composition of the initial ten habitat type groups, we further collapsed these categories into four habitat type groups. Table 4 presents large snag densities for the following preliminary collapsed habitat type groups: *Warm* is comprised of warm and very dry, warm and dry, warm and moist; *Cool 1* is comprised of cool and moist, cool and dry to moist, cool and moist to wet, warm to cool and dry; *Cold* is comprised of cold and dry to wet, and cold and dry, which had similar ranges of snags. *Cool and Wet* has remained the same. In the wilderness/roadless areas, the density of snags per acre 15.0" DBH and larger in the *Warm* group is less than the snag density of the other groups. Since the confidence interval of the Warm group does not overlap the confidence interval of the other groups, it is a statistically significant difference.

Table 4: Mean snag density per acre and 90% confidence interval, by diameter classes, inside and outside of wilderness/roadless areas by preliminary collapsed habitat type groups, for all eastside Forests.

Area	Collapsed Habitat Type Groups	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	Warm	5.2	3.4	7.3	1.4	0.8	2.0	0.3	0.2	0.5	180	180
	Cool 1	13.8	11.7	16.1	2.9	2.3	3.6	0.6	0.4	0.8	356	356
	Cool & Wet	18.3	12.1	25.1	5.5	3.2	8.2	1.5	0.5	2.9	39	39
	Cold	16.1	12.5	19.9	4.0	2.9	5.1	1.1	0.7	1.4	155	155
Outside Wilderness / Roadless	Warm	2.4	1.6	3.2	0.8	0.5	1.1	0.2	0.1	0.3	216	216
	Cool 1	5.5	3.9	7.2	1.1	0.6	1.6	0.2	0.1	0.4	172	172
	Cool and Wet	6.7	1.5	13.7	1.6	0.0	4.2	0.0	0.0	0.0	15	15
	Cold	15.3	6.5	26.2	3.5	1.3	6.1	0.3	0.0	0.8	20	20

Fourth, after assessing large snag abundance (Table 4), productivity, and species composition of the four preliminary collapsed habitat type groups, we collapsed these categories into three habitat type groups to estimate large snag densities. The cool and wet type was not represented well across any of the Forests and had a small number of plots for the entire eastside so it was included with the *Cool* type. The productivity, species composition, and management objectives of the cool and wet habitat type group is more similar to the *Cool* than the *Cold* group.

Table 5a: Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by final habitat type groups, for all eastside Forests.

Area	Final Habitat Type Groups	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Tot # PSUs	# Forested PSUs
		Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	Warm	5.2	3.4	7.3	1.4	0.8	2.0	0.3	0.2	0.5	180	180
	Cool	14.3	12.2	16.4	3.2	2.6	3.9	0.7	0.5	0.9	395	395
	Cold	16.1	12.6	19.9	4.0	2.9	5.1	1.1	0.7	1.4	155	155
Outside Wilderness / Roadless	Warm	2.4	1.6	3.2	0.8	0.5	1.1	0.2	0.1	0.3	216	216
	Cool	5.6	4.1	7.2	1.1	0.7	1.7	0.2	0.1	0.4	187	187
	Cold	15.3	6.5	26.2	3.5	1.3	6.1	0.3	0.0	0.8	20	20

Table 5b: Mean live tree density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by final habitat type groups, for all eastside Forests.

Area	Final Habitat Type Groups	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Tot # PSUs	# Forested PSUs
		Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	Warm	49.2	43.3	55.2	13.6	11.3	16.0	3.9	2.9	4.9	180	180
	Cool	57.9	53.4	62.6	11.7	10.3	13.2	2.6	2.1	3.1	395	395
	Cold	59.1	51.8	66.9	11.3	9.0	13.8	2.7	2.0	3.6	155	155
Outside Wilderness / Roadless	Warm	48.6	43.6	53.7	11.5	9.7	13.4	3.0	2.3	3.8	216	216
	Cool	50.2	43.8	56.7	8.0	6.3	9.9	1.6	1.1	2.2	187	187
	Cold	56.7	35.5	80.1	13.6	6.6	21.5	3.6	1.2	6.5	20	20

Table 5a and 5b show densities for snags and live-trees for the final *collapsed* habitat type groups: *Warm* is comprised of warm and very dry, warm and dry, warm and moist; *Coo1* is comprised of cool and moist, cool and dry to moist, cool and moist to wet, warm to cool and dry, and cool and wet; *Cold* is comprised of cold and dry to wet, and cold and dry. The habitat type groups of cold forest, cool forest, and warm forest have characteristic disturbance regimes, which create snags and are related to the density of snags.

Both snag density and large live trees available for snag recruitment (Table 5a and 5b) vary by habitat group. Furthermore, snags and live trees become less common as the diameter class increases from 10"+ DBH to 20"+ DBH. Considering only the wilderness/roadless areas, the cold habitat group has the highest snag densities. Although the warm habitat type group has the highest large live-tree densities, it has the smallest snag densities. This is likely due to the high productivity of those habitat type groups and the historical frequent low severity fires, which kept stocking lower, providing the opportunity for trees to grow larger over time. These frequent fires however, kept larger snags from developing in great numbers. For specific Forest comparisons, see Table 2b in Appendix C.

When looking across the entire eastside of the Region, there are adequate plots numbers (*n*), by the final snag analysis habitat type groups, both within and outside of the wilderness/roadless areas, to make comparisons between the density of snags within and outside of wilderness/roadless areas by habitat type groups. This is true for the estimates of many of the Forests, see Appendix C, Table 2a. Generally, there are more plots (*n)* in the Cold habitat type group within the wilderness/roadless and less plots in the Warm habitat type group, but there are enough plots so that comparisons of densities within the groups are appropriate. However, the Custer has a small amount of wilderness/roadless lands, as seen in the low number of plots within the wilderness roadless areas. Furthermore, the Forest is predominately comprised of warm habitat type groups with very few plots in the Cool and Cold groups occurring on the Forest. The Helena and Lewis and Clark National Forests also have a smaller number of acres that have habitat types from the Cold group.

3.3 Comparison of Snag Density within and outside of Lodgepole Pine Dominance Group
Fifth, snag and live density by diameter class was explored for lodgpole pine (*Pinus contorta*, PICO) dominance groups. Examining the lodgepole pine dominance group separately is appropriate for several reasons. Lodgepole pines are uniquely characterized by their growth, form, and lack of wind firmness (Alexander 1986, Lotan 1983). Consequently, lodgepole pines fail to grow as large as other common tree species on eastside Forests, and therefore do not contribute as many large diameter snags. Analyzing the lodgepole pine dominance group separately is consistent with previous Region 1 analyses of fire ecology (Fischer and Clayton 1983) and snag density (Harris 1999).

Dominance groups of PICO and Non-PICO were classified according to the R1 Existing Vegetation Classification System. See Appendix D for documentation on how these groups are derived. These dominance groups are the same classification used when developing R1-VMap for eastside Forests so results can be related to VMap. For further information on dominance types see *Region One Vegetation Council Existing Forested Vegetation Classification System and Adaptation to Inventory and Mapping* (Berglund and others 2008).

There is a statistically significant difference in live and dead trees per acre 15.0" DBH and larger in the lodgepole pine dominance group, as well as overall a significantly significant difference in smaller 10"+ snags and live trees, see Table 6a and 6b.

Table 6a: Mean snag density per acre with 90% confidence interval, by diameter classes, inside and outside of wilderness/roadless areas by lodgepole pine dominance group (PICO) and all other dominance groups, for all eastside Forests.

Area	Final Habitat Type Groups	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Tot # PSUs	# Forested PSUs
		Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	All Other Groups	13.2	11.5	15.0	3.4	2.8	3.9	0.9	0.7	1.1	504	504
	PICO	10.1	7.8	12.6	1.9	1.2	2.6	0.2	0.1	0.4	243	243
Outside Wilderness / Roadless	All Other Groups	5.3	4.0	6.7	1.5	1.1	1.9	0.4	0.2	0.5	259	259
	PICO	2.9	1.8	4.2	0.4	0.2	0.8	0.0	0.0	0.1	169	169

Table 6b: Mean live tree density per acre with 90% confidence interval, by diameter classes, inside and outside of wilderness/roadless areas by lodgepole pine dominance group (PICO) and all other dominance groups, for all eastside Forests.

Area	Final Habitat Type Groups	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Tot # PSUs	# Forested PSUs
		Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	All Other Groups	57.8	53.8	61.7	15.5	14.1	17.0	4.1	3.5	4.6	504	504
	PICO	49.3	43.4	55.3	4.4	3.5	5.4	0.6	0.4	0.8	243	243
Outside Wilderness / Roadless	All Other Groups	52.8	47.7	58.0	14.2	12.4	16.2	3.6	3.0	4.4	259	259
	PICO	44.0	38.0	50.3	3.6	2.6	4.6	0.5	0.2	0.9	169	169

3.4 Final groupings for snag density analysis on Eastside Forests

Finally, we calculated snag and live tree density estimates for lodgepole pine and non-lodgepole dominance groups. The non-lodgepole pine dominance group was further divided by habitat type group.

Table 7a: Mean snag density per acre with 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups, by habitat type group; for all eastside Forests.

Area	Dominance Group	Final Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	All Other Groups	Warm	4.4	3.0	6.1	1.4	0.8	2.1	0.4	0.2	0.6	152	152
		Cool	18.5	15.4	21.7	4.4	3.5	5.3	1.1	0.8	1.5	201	201
		Cold	16.5	12.7	20.7	4.3	3.2	5.6	1.2	0.8	1.6	136	136
	PICO	All	10.1	7.8	12.6	1.9	1.2	2.6	0.2	0.1	0.4	243	243

Table 7b: Mean live tree density per acre with 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups, by habitat type group; for all eastside Forests.

Area	Dominance Group	Final Habitat Type Group	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	All Other Groups	Warm	51.3	44.8	58.1	15.1	12.5	17.9	4.4	3.4	5.6	152	152
		Cool	66.4	60.2	72.8	18.8	16.4	21.3	4.6	3.8	5.5	201	201
		Cold	57.5	49.8	65.4	12.4	9.8	15.2	3.1	2.2	4.0	136	136
	PICO	All	49.3	43.4	55.3	4.4	3.5	5.4	0.6	0.4	0.8	243	243

Table 7a and 7b show estimates of snags and large-trees for the final snag analysis groups. Tables 7a and 7b show fewer 15"+ live trees and snags in the lodgepole group compared to all other groups, as expected. There are significant differences in the estimates of live and dead trees that are 10"+ DBH and the other diameter classes. In addition, due to the ongoing and future predicted bark beetle epidemics and fire, many more snags will be available in the 10"+DBH compared to the pre-bark beetle inventory data. See Appendix E. This same information for each Forest is located in Table3a and 3b in Appendix C. When looking across the entire eastside of the Region, there are adequate plots numbers (*n*), by the final snag analysis groups, both within and outside of the wilderness/roadless areas, to make comparisons between the density of snags within and outside of wilderness/roadless areas by dominance type; PICO and non-PICO, and habitat type groups; Warm, Cool, and Cold. However, for some Forests, the acres on the Forest that are comprised of in wilderness/roadless areas, such as the Custer, is small. Furthermore, the Forest is predominately comprised of warm habitat type groups with very few habitat types from the Cool and Cold groups occurring on the Forest. The Helena and Lewis and Clark National Forests also have a smaller number of acres that have habitat types from the Cold group. For many Forests, the estimates from Table 3, Appendix C are used as a basis for possible Forest –wide goals or desired conditions (Table 12). However, for some Forests, the estimates for the entire Forest, not broken out by wilderness/roadless areas were used; see Table 5, Appendix C.

3.5 Overview of Final Snag Analysis Groups

Snag Analysis Group 1: Warm habitat types with mixed conifer dominance groups (other than PICO)

See Appendix B for a list of habitat types included in the Warm group. These habitats are warm and dry to moist, dominated by Douglas fir, ponderosa pine, limber pine, with some lodgepole pine and spruce mixed in. These types generally correspond to fire groups 1-6, (Fischer and Clayton 1983). These habitat type groups were lumped into this snag analysis group as they generally occur in dry forest conditions on east-side Forests with similar fire regimes and resulting snag densities. These types are well represented across all of the National Forests in this zone.

Prior to 1900, cool underburns at intervals of 5 to 20 years on the driest habitats and 35 to 40 years on the others in this habitat type group promoted open stands. Following fire-free periods of extended length multiple storied stands would develop setting the stage for stand replacing severe fires at long intervals between 150 and 300 years.

Stands in this group may be single- or multi-storied. A single story is most common during seral stages with frequent fire return intervals. Large Douglas-fir dominate many of these habitat types under seral and climax conditions with ponderosa pine on some habitat types and limber pine on very dry sites.

Because of the historical fire regimes, creation of snags was generally at low numbers, and low in frequency, but fairly constant over time. In addition, down wood remained lower on these sites compared to snag and fire groups with less frequent fire. (Fischer and Clayton 1983)

Snag Analysis Group 2: Cool habitat types with mixed conifer dominance groups (other than PICO)
See Appendix B for a list of habitat types included in the Cool group. These types generally correspond to fire groups 8 and 9 in Fischer and Clayton, 1983. These habitat types are cool and dry, moist and wet, dominated by spruce and subalpine fir. Douglas-fir can be found, to some extent, on the *cool and moist to wet* habitat types. These habitat type groups were lumped into this snag analysis group as they generally occur on the cool forest conditions on the east-side Forests with similar historical fire regimes and resultant snag densities. These types are well represented across all of the National Forests in this zone.

Prior to 1900, fire were generally stand replacing with long fire return intervals from 90 to more than 200 years. This promoted single story stands in early and mid-seral stages, often developing into multi-stories stands later in stand development depending on local fire return interval. Some mixed severity fire burned between stand replacing events. Following fire-free periods of extended length, multiple storied stands would develop setting the stage for stand replacing severe fires at long intervals between 150 and 300 years.

Stands in this group may be single or multistoried. A single story is most common during seral stages with frequent fire return intervals. Large spruce and subalpine-fir dominate a majority of these sites with Douglas-fir dominating on some of types under seral and climax conditions.

Because of the historical fire regimes, creation of snags was generally a pulse event, creating many snags in early-seral conditions, fewer in mid-seral, and more in late-seral.

Snag Analysis Group 3: Cold habitat types with mixed conifer dominance groups (other than PICO)
See Appendix B for a list of habitat types included in the Cold habitat type group. These types generally correspond to fire group 10 in Fischer and Clayton, 1983. These habitat type groups were lumped into this snag analysis group as they generally occur in cold forest conditions on the east-side Forests. Whitebark pine dominated stands may occur on the warmer, lower elevations, but more likely on the upper elevation habitat types. Natural fire frequency is thought to be from 70 to 350 years. Fires occuring after longer return intervals tended to be more severe and stand replacing. Fires occurring after shorter periods would provide thinning of stands and smaller patch fires.

Stands in this group may be single or multistoried. A single story is most common during late-seral stage or in stands with frequent light underburns. Multistoried stands may be common where overstory tree stocking is light at any successional stage. Whitebark pine will dominate these habitat types under seral conditions, often sharing the site with lodgepole pine in *cold to dry and wet* habitat types. Spruce and/or subalpine fir may be the climax dominants, depending on the habitat type series, although whitebark pine may remain in the stands for a long time.

Snag Analysis Group 4: Lodgepole Pine dominance type, all habitat type groups
Lodgepole Pine is a major dominance type in Region 1 and has characteristics that have warranted special management attention in the past (Hughes 1990). This snag analysis group generally corresponds to fire group 7 of Fischer and Clayton, 1983. Lodgepole pine was broken out as a snag analysis group as the fire regime is dominated by stand replacing fire, with some mixed severity, which had a thinning effect in some habitat types. Stand replacing fire return

intervals were 100 to 500 years (Fischer and Clayton 1983). However stands reaching 60 to 80 years of age with stand size of over 8" in diameter, often experience severe mortality by mountain pine beetle creating snags and down fuel leading to potential severe fire effects depending on time since the infestation (Jenkins 2007). On lodgepole pine dominated sites, stand-replacing fire was most common and severity was affected by periodic out breaks of mountain pine beetle that led to large fuel loads and pulse events for snags.

Due to the tight stocking in most lodgepole pine stands, average stand diameters are generally smaller than mixed conifer stands. As a result, few snags or live trees over 15" DBH occur see table 7. Due to this dominant characteristic of the silvics of lodgepole pine, the group was not broken out by habitat type groups.

3.6 Analysis of snag density within successional stages

Snag densities and their relationship to successional stages provide context for managing forests in the short- and long-term. This information can assist with the development of site-specific stand level silvicultural prescriptions and the desired conditions over time, for the Target Stand, which is an essential part of the prescription process.

Harris (1999) found that snags were the result of several functions. There are large-live "remnant" trees surviving from the previous late-seral stage through the early and potentially mid-seral stages, which ultimately die. There are large snags, which are remnants from the previous late-seral stage trees, which were created by the disturbance that brings the stand to the early-seral stage. Finally, there is recruitment of snags during the development of late successional stage communities. We incorporated all of these aspects of snag creation into our analysis.

Wisdom and Bate (2008) found relationships of snag density to seral stage. There is not a standard definition of seral stage among the Agency. Wisdom and Bates used a definition from the Flathead National Forest, which was used in the 1990's. This definition, which looked at the trees per acre in three diameter classes and the diameter class with the most trees, determines the seral stage. For our analysis, seral stage was based on the R1 vegetation council existing vegetation classification definition of stand size, which is determined from the basal area weighted average diameter (Berglund and others, 2008), and has been used by the Region since 2004. A stand size between 0.0"-4.9" is considered early-seral, from 5.0" – 9.9" is mid-seral, and late-seral has a stand size of 10.0" and larger. These stand size class definitions are displayed in various Region 1 reports, are consistent with attributes displayed on R1-VMap for the eastside, and can be algorithmically applied to all levels of inventory data.

Table 8a: Mean snag density per acre with 90% confidence interval, in wilderness and roadless areas, by diameter class and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups, by habitat type groups; for all eastside Forests.

Area	Dominance Group	Final Habitat Type Group	Seral Stage (Size Class)	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	All Other Groups	Warm	0-4.9	8.7	1.2	19.5	3.6	0.3	8.2	0.8	0.0	1.9	16	16
			5-9.9	2.2	0.7	3.9	0.5	0.0	1.1	0.3	0.0	0.7	45	45
			10+	4.8	3.0	6.9	1.5	0.8	2.2	0.4	0.2	0.6	91	91
		Cool	0-4.9	31.3	17.4	46.4	8.0	4.2	12.3	1.8	0.3	3.7	25	25
			5-9.9	9.8	6.1	14.0	0.9	0.3	1.7	0.3	0.0	0.6	57	57
			10+	19.9	16.1	23.9	5.2	4.0	6.6	1.4	0.9	1.9	119	119
		Cold	0-4.9	15.4	1.0	32.8	2.8	0.0	6.1	0.7	0.0	1.6	13	13
			5-9.9	11.1	6.2	16.9	3.7	1.5	6.3	1.2	0.5	2.1	49	49
			10+	20.3	14.8	26.4	5.0	3.6	6.5	1.3	0.8	1.9	74	74
	PICO	All	0-4.9	28.0	16.8	40.0	6.4	2.9	10.4	1.1	0.3	2.2	35	35
			5-9.9	3.7	2.3	5.2	0.3	0.1	0.5	0.0	0.0	0.0	151	151
			10+	16.2	11.3	21.5	3.3	1.9	5.0	0.2	0.0	0.5	57	57
Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9	4.5	1.5	8.2	2.0	0.6	3.8	0.1	0.0	0.4	21	21
			5-9.9	1.9	0.4	3.9	0.3	0.0	0.9	0.2	0.0	0.5	39	39
			10+	2.2	1.3	3.3	0.8	0.4	1.3	0.3	0.1	0.5	117	117
		Cool	0-4.9	6.1	0.0	19.5	0.7	0.0	2.3	0.0	0.0	0.0	7	7
			5-9.9	6.6	1.7	13.0	1.6	0.0	4.1	0.0	0.0	0.0	18	18
			10+	13.1	8.8	17.8	3.2	1.6	5.0	1.0	0.4	1.7	38	38
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	11.2	0.0	33.6	4.4	0.0	14.5	1.0	0.0	2.9	3	3
			10+	31.0	13.5	53.4	7.2	3.2	11.6	0.4	0.0	1.5	8	8
	PICO	All	0-4.9	2.1	0.0	4.9	0.2	0.0	0.7	0.0	0.0	0.0	34	34
			5-9.9	1.8	0.8	3.1	0.3	0.1	0.6	0.0	0.0	0.1	103	103
			10+	7.4	3.5	12.1	1.0	0.0	2.5	0.0	0.0	0.2	32	32

Table 8a displays estimates of snag density within and outside of the wilderness and roadless areas by seral stage for the final snag analysis groups. Table 8b displays the estimates for live trees. The cool habitat type group and the lodgepole pine group have more snags in the early-seral stage. These habitat type groups tend to have a greater proportion of stand-replacing fires (Fischer and Clayton, 1983), causing increased mortality of large-trees. Furthermore, since spruce and subalpine fir, which are intolerant to fire, dominate the cool sites, high mortality rates are expected. The warm forest habitat types also show an increase of larger-diameter snags in the early-seral stage. This may be due to fire's role as a stand replacement agent becoming more pronounced when the natural fire-free interval is increased through fire suppression and a changing climate or could be from bark beetle disturbance (Fischer and Clayton, 1983). This pattern could explain some of the uncertainties of historical fire regime related to snag creation, there probably are more snags being created in the early-seral stage on warm habitat type groups currently due, in part, to fire suppression on these sites in the past. All habitat type groups show fewer numbers of snags during the mid-seral conditions, since many snags transition to down woody debris in this successional stage (Jenkins 2007, Harris 1999, Fisher and Clayton 1983, Smith 1999). There is generally an increase in the number of live large trees and, therefore, snags as the forest matures (Table 8a; Harris 1999) from mid- to late-seral stage. Table 8b also shows the persistence of remnant large live trees into the early-seral stage created from previous disturbance events. For specific Forest comparisons, see Table 4a and 4b in Appendix C. Snag abundance by successional stage have less reliable estimates for each Forest, because of the low number of FIA plots within each seral stage by Forest.

Table 8b: Mean live tree density per acre with 90% confidence interval, in wilderness and roadless areas, by diameter class and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups, by habitat type groups; for all eastside Forests.

Area	Dominance Group	Final Habitat Type	Seral Stage (Size	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI - Lower	90% CI - Upper	Mean	90% CI - Lower	90% CI - Upper	Mean	90% CI - Lower	90% CI - Upper		
In Wilderness / Roadless	All Other Groups	Warm	0-4.9	1.3	0.0	3.3	0.2	0.0	0.8	0.2	0.0	0.8	16	16
			5-9.9	32.3	24.4	40.7	2.3	1.2	3.7	0.1	0.0	0.4	45	45
			10+	69.5	60.7	78.5	24.1	20.3	27.9	7.3	5.7	9.0	91	91
		Cool	0-4.9	0.9	0.0	2.1	0.9	0.0	2.1	0.1	0.0	0.5	25	25
			5-9.9	52.6	43.5	62.0	4.6	2.9	6.5	0.7	0.3	1.2	57	57
			10+	86.9	79.2	94.8	29.4	26.3	32.7	7.5	6.2	8.8	119	119
		Cold	0-4.9	1.4	0.0	4.4	0.3	0.0	1.1	0.0	0.0	0.0	13	13
			5-9.9	35.8	27.4	44.7	2.0	1.0	3.1	0.3	0.1	0.6	49	49
			10+	81.8	70.7	93.3	21.4	17.3	25.7	5.4	4.0	7.0	74	74
	PICO	All	0-4.9	0.6	0.0	1.6	0.1	0.0	0.4	0.0	0.0	0.0	35	35
			5-9.9	44.0	38.1	50.1	2.3	1.6	3.0	0.1	0.0	0.2	151	151
			10+	93.1	78.9	108.0	12.8	10.1	15.6	2.3	1.5	3.1	57	57
Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9	1.9	0.3	4.1	0.6	0.0	1.4	0.2	0.0	0.6	21	21
			5-9.9	42.7	32.3	54.0	2.2	1.0	3.6	0.0	0.0	0.1	39	39
			10+	58.3	51.6	65.3	19.2	16.4	22.0	5.3	4.1	6.5	117	117
		Cool	0-4.9	1.5	0.0	5.1	0.0	0.0	0.0	0.0	0.0	0.0	7	7
			5-9.9	48.7	30.1	70.0	7.3	3.1	12.2	0.9	0.0	2.4	18	18
			10+	84.3	69.4	100.3	24.4	18.8	30.4	6.0	4.0	8.2	38	38
		Cold	0-4.9	3.5	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	68.2	2.0	175.8	2.1	0.0	6.2	0.0	0.0	0.0	3	3
			10+	94.0	63.0	126.5	32.0	19.4	44.6	9.0	3.9	14.8	8	8
	PICO	All	0-4.9	0.4	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	34	34
			5-9.9	45.1	38.0	52.4	2.0	1.2	3.0	0.2	0.0	0.4	103	103
			10+	86.6	71.9	101.8	12.3	8.8	15.9	2.2	0.8	4.0	32	32

By displaying both estimates of within and outside of the wilderness/roadless areas, Table 8a and 8b provide context into the current condition of snag and live tree distributions, by seral stage on lands that could be treated and how they differ for wilderness/roadless areas. This may provide insight into the range of snags that may be desirable to leave within a project treatment area, and, potentially, live trees to serve as remnant trees, which will eventually be recruited into snags.

Table 9a: Live, Dead, and Total (both live and dead) tree density with 90% confidence interval for trees 15.0" DBH and larger by seral stage (size class) for lodgepole pine dominance group (PICO) and all other dominance groups, by final habitat type groups in wilderness and roadless areas, for all eastside Forests.

Area	Dominance Group	Final Habitat Type Group	Seral Stage (Size Class)	Live Trees			Dead Trees (snags)			Total Trees (live &			Total Number PSUs	Number Forested PSUs
				Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	All Other Groups	Warm	0-4.9	0.2	0.0	0.8	3.6	0.3	8.2	3.9	0.5	8.4	16	16
			5-9.9	2.3	1.2	3.7	0.5	0.0	1.1	2.8	1.4	4.4	45	45
			10+	24.1	20.3	27.9	1.5	0.8	2.2	25.5	21.6	29.6	91	91
		Cool	0-4.9	0.9	0.0	2.1	8.0	4.2	12.3	8.9	5.0	13.2	25	25
			5-9.9	4.6	2.9	6.5	0.9	0.3	1.7	5.5	3.7	7.5	57	57
			10+	29.4	26.3	32.7	5.2	4.0	6.6	34.7	31.2	38.3	119	119
		Cold	0-4.9	0.3	0.0	1.1	2.8	0.0	6.1	3.1	0.4	6.4	13	13
			5-9.9	2.0	1.0	3.1	3.7	1.5	6.3	5.7	3.3	8.5	49	49
			10+	21.4	17.4	25.8	5.0	3.6	6.5	26.5	22.2	30.9	74	74
	PICO	All	0-4.9	0.1	0.0	0.4	6.4	2.9	10.4	6.5	3.0	10.5	35	35
			5-9.9	2.3	1.6	3.0	0.3	0.1	0.5	2.6	1.9	3.4	151	151
			10+	12.8	10.1	15.6	3.3	1.9	5.0	16.1	12.8	19.7	57	57

Table 9b: Live, Dead, and Total (both live and dead) tree density with 90% confidence interval for trees 10.0" DBH and larger by seral stage (size class) for lodgepole pine dominance group (PICO) and all other dominance groups, by final habitat type groups in wilderness and roadless areas, for all eastside Forests.

Area	Dominance Group	Final Habitat Type Group	Seral Stage (Size Class)	Live Trees per Acre 10"+			Dead Trees (snags) per Acre 10"+			Total Trees (live & dead) per Acre 10"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	All Other Groups	Warm	0-4.9	1.3	0.0	3.3	8.7	1.2	19.5	10.0	2.3	20.9	16	16
			5-9.9	32.3	24.4	40.7	2.2	0.7	3.9	34.4	25.9	43.6	45	45
			10+	69.5	60.7	78.5	4.8	3.0	6.9	74.3	65.0	84.0	91	91
		Cool	0-4.9	0.9	0.0	2.1	31.3	17.4	46.4	32.2	18.4	47.1	25	25
			5-9.9	52.6	43.5	62.0	9.8	6.1	14.0	62.6	52.1	73.4	57	57
			10+	86.9	79.2	94.8	19.9	16.1	23.9	107.1	98.2	116.2	119	119
		Cold	0-4.9	1.4	0.0	4.4	15.4	1.0	32.8	16.8	3.2	34.0	13	13
			5-9.9	35.8	27.4	44.7	11.1	6.2	16.9	46.9	36.4	58.0	49	49
			10+	81.8	70.7	93.3	20.3	14.8	26.4	102.0	90.0	114.4	74	74
	PICO	All	0-4.9	0.6	0.0	1.6	28.0	16.8	40.0	28.6	17.7	40.6	35	35
			5-8.9	44.0	38.1	50.1	3.7	2.3	5.2	47.7	41.3	54.2	151	151
			10+	93.1	78.9	108.0	16.2	11.3	21.5	109.3	94.3	125.0	57	57

To further explore how large-trees transition into snags from large-live remnant trees, estimates of snags and live trees by individual classes and combined by the 10"+ DBH, 15"+DBH, and 20"+ DBH diameter classes, by seral stage (size class) were derived. In the early-seral stage, the total trees are remnant live and dead trees remaining from the previous late-seral condition. Harris (1999) found that snag creation was a function of several general categories of snags. There are large-live "remnant" trees surviving from the previous late-seral stage and found in the early and potentially mid-seral stages, this can be seen in the cool group, large-live trees remaining in the early-seral condition. In addition, there are remnant snags, which are created by the disturbance that brings the stand to the early-seral stage; this can be seen in the snag estimates in the early-seral stage for all of the snag analysis groups. Finally, there is recruitment of snags during the development of late successional stage communities, as is a part of natural succession, and can be seen in all of the snag analysis groups.

Table 9a and 9b as in table 8a and 8b, also provides an insight into the range of live and dead trees, which may be desirable to retain within a project treatment area to serve as snags for habitat and remnant trees, which will eventually be recruited into snags.

3.7 Analysis of snag density spatially

Not only is it important to understand the distribution of snags and large-live remnant trees over time during various stages of succession, but it is important to explore how snags are distributed spatially across the landscape. Harris (1999) found a clumpy spatial distribution of snags due, in part, to the disturbances, which create snags, fire, and insects.

Table 10: Percent of plots having the incidence of snags, by diameter class, for eastside Forests in wilderness and roadless areas, by final dominance type and habitat type groups.

Area	Dominance Group	Final Habitat Type Group	Percent of Plots with Snags 10"+			Percent of Plots with Snags 15"+			Percent of Plots with Snags 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	All Other Groups	Warm	9.9%	7.1%	12.8%	5.9%	3.8%	8.2%	3.0%	1.7%	4.5%	152	152
		Cool	29.1%	25.3%	32.9%	16.1%	13.2%	19.1%	7.0%	5.0%	9.0%	201	201
		Cold	26.9%	22.4%	31.6%	16.6%	13.0%	20.4%	8.4%	5.9%	11.1%	136	136
	PICO	All	14.7%	11.8%	17.6%	5.3%	3.6%	7.0%	1.2%	0.5%	2.2%	243	243

Table 11: Percent of plots having the incidence of snags, by diameter class, for eastside Forests in wilderness and roadless areas, by final dominance type and habitat type groups, by seral stage (size class).

Area	Dominance Group	Final Habitat Type Group	Seral Stage (Size Class)	Percent of Plots with Snags 10"+			Percent of Plots with Snags 15"+			Percent of Plots with Snags 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
In Wilderness / Roadless	All Other Groups	Warm	0-4.9	16.3%	4.0%	30.0%	11.3%	1.3%	23.3%	5.0%	0.0%	11.7%	16	16
			5-9.9	5.3%	1.7%	9.8%	2.7%	0.0%	6.1%	1.8%	0.0%	4.2%	45	45
			10+	11.0%	7.4%	14.9%	6.6%	4.0%	9.5%	3.3%	1.6%	5.3%	91	91
		Cool	0-4.9	33.6%	20.9%	46.7%	24.8%	14.1%	36.0%	8.8%	2.6%	16.2%	25	25
			5-9.9	16.8%	11.5%	22.7%	4.2%	1.6%	7.3%	1.8%	0.0%	3.8%	57	57
			10+	33.9%	29.0%	38.9%	20.0%	16.0%	24.1%	9.1%	6.3%	12.0%	119	119
		Cold	0-4.9	20.0%	2.1%	38.8%	10.8%	0.0%	22.5%	4.6%	0.0%	11.1%	13	13
			5-9.9	18.8%	12.1%	26.0%	11.8%	6.5%	17.8%	8.2%	3.6%	13.5%	49	49
			10+	33.5%	27.4%	39.7%	20.8%	15.7%	26.1%	9.2%	6.0%	12.7%	74	74
	PICO	All	0-4.9	32.0%	21.0%	43.5%	15.4%	8.1%	23.5%	6.9%	2.1%	12.7%	35	35
			5-8.9	6.1%	4.0%	8.3%	1.1%	0.3%	2.0%	0.0%	0.0%	0.0%	151	151
			10+	26.7%	20.0%	33.7%	10.2%	6.0%	14.7%	1.1%	0.0%	2.8%	57	57

We looked at how snags were distributed spatially by looking at how often FIA plots had snags 10"+ DBH, 15"+ DBH, and 20"+ DBH on them. Table 10 shows the proportion of plots that have large snags by our final snag analysis groups. Table 11 shows the proportion of plots with snags by successional stages. As can be seen in these two tables, the distribution of snags across a landscape is not uniform. As an example, Table 11 shows in the early stage class in the warm group snags occur on only 16.3% of the area in that class. This, in part, is because many snags are the result of periodic, broad-level disturbances, fire and insects, which create large areas which have more snags than outside of those disturbed areas.

Since snags naturally occur in a clumpy manner, within a project treatment area, one should consider leaving snags in a clumpy distribution as well. The ranges of snags that are left within the entire project area, Table 8a, should be the average density *across* the entire project treatment area and not to every treated acre within a project area.

4.0 Results

Snags are naturally created over time and by various disturbance processes taking place across the landscape. Appendix E shows a compilation of disturbances in Region 1 from 2000-2007. These provide context of acres of disturbance, both natural and man-made. Fire, both prescribed and natural, and insect and disease disturbances tend to create snags while harvest can reduce

snag density. From 2000-2007 more than 300,000 acres were affected by fire, more than 5 million acres were affected by insects, and less than 45,000 acres were harvested or thinned. Furthermore, due to the ongoing and predicted future increases in bark beetle epidemics and fire events, it is expected that there will be increasing snag densities in all diameter classes over time.

4.1 Ranges of Snags by Forest:

Table 12: Snags per Acre for Eastside Forests for snag analysis groups: lodgepole pine (PICO) dominance groups and all other dominance groups by habitat type group; by diameter class.

Forest	Dominance group	Habitat Type Group	Ranges for Snags per acre by diameter class (current mean)		
			≥ 10.0" DBH	≥ 15.0" DBH	≥ 20.0" DBH
Beaverhead-Deerlodge	All Other Groups	Warm	1.6 - 7.3 (2.9)	0.4 - 2.4 (1.1)	0.1 - 0.8 (0.4)
		Cool	13.0 - .24.9 (14.6)	2.3 - 5.4 (2.8)	0.3 - 1.1 (0.5)
		Cold	13.7 - 27.9 (20.1)	3.7 - 8.6 (5.9)	0.8 - 2.4 (1.4)
	PICO	All	3.2 - 7.2 (3.4)	0.5 -1.6 (0.6)	-
Custer	All Other Groups	Warm	1.4 - 4.7 (2.9)	0.4 - 1.6 (1.0)	-
		Cool	5.8 - 46.8 (20.6)	1.4 – 17.3 (7.8)	-
		Cold	4.0 - 32.0 (15.9)	0.6 – 5.4 (3.0)	0.2 – 2.4 (1.0)
	PICO	All	1.7 – 18.5 (9.3)	-	-
Gallatin	All Other Groups	Warm	2.3-8.7 (4.1)	0.8 – 4.4 (1.8)	0.2 – 1.6 (0.6)
		Cool	19.8-34.0	5.0 – 9.6 (6.7)	1.2 – 3.3 (1.9)
		Cold	8.6-19.3	2.4 – 5.9 (4.2)	0.8 – 2.1 (1.4)
	PICO	All	11.2 – 24.2	1.5 – 6.0 (3.0)	-
Helena	All Other Groups	Warm	1.1 – 4.8	0.1 - 1.4 (0.7)	-
		Cool	7.8 – 21.7	1.0 – 5.5 (3.0)	.3 – 2.2 (1.1)
		Cold	-	-	-
	PICO	All	3.9 – 12.7	-	-
Lewis and Clark	All Other Groups	Warm	1.6 - 8.4	0.3 – 2.9 (1.2)	-
		Cool	7.8 - 15.9	1.5 - 3.5 (2.3)	0.3 - 1.2 (0.6)
		Cold	4.1 - 24.6	0.4 – 4.8 (2.4)	-
	PICO	All	8.4 - 23.1	1.1 - 5.3 (2.1)	-

Table 12 displays ranges of snags that could be monitored, over time, at the broad-level as new FIA data is acquired and available for analysis. The current Forest-wide means are displayed under the ranges in parentheses. These are the current Forest mean snag densities by diameter class as reported in Appendix C Table 5.

These ranges for the Beaverhead-Deerlodge; Gallatin; Custer non-PICO dominance group and cool and cold habitat type groups; and Lewis and Clark PICO dominance group and non-PICO dominance group with Warm and Cool habitat type groups are the 90% confidence interval lower and upper bound for the Forest specific estimates of snag density derived within roadless/wilderness lands, as displayed in Appendix C Table 3a.

The ranges for the Helena; Custer non-PICO dominance group and warm habitat type group; and the Lewis and Clark non-PICO dominance group and cold habitat type group are based on the 90% confidence interval lower and upper bound for the specific forest-wide estimates derived for the *entire* Forest displayed in appendix C, Table 5. These ranges were used since there were not enough plots within the wilderness/roadless areas on these perspective Forests within the snag analysis groups to derive an estimate with a confidence interval lower-bound above 0.0

Some of the cells within table 12 do not have ranges displayed. For the PICO dominance group, this is due to the fact that on all Forests lodgepole pine 20.0" DBH and larger are less common across the landscape and estimates of the density of snags 20.0" and larger within this dominance group include a lower bound of 0.0, see Table 6a. For some Forests, this is the case for snags 15.0" and larger within the PICO dominance group. Furthermore, due to the fall-rates of dead lodgepole, they do not remain standing throughout all seral stages (table 8a). The Helena does not have ranges displayed for the non-PICO dominance group and cold habitat type group since it is not a commonly found on the Forest. The Helena may want to use ranges from the non-PICO dominance group cool habitat type group or use ranges from a neighboring Forest as dictated by information needs. Lastly, the Custer does not have ranges displayed for the non-PICO warm and cool habitat type groups. This is due to the fact that snags 20.0" and larger are not common within these types on the Custer. Therefore, it may be useful to retain large snags within these types.

4.2 Snag Estimates by Seral Stage

Table 13 provides information on ranges of snags per acre by seral stage. This information is from the eastside estimates of snag and live tree density within wilderness and roadless areas displayed in Table 8a and 8b. In many of the snag analysis groups, there are statistically significant differences in the estimates of live and dead trees that are 10"+ DBH and the other diameter classes. It should be noted that large-snags, those 15" and larger in diameter are less common than smaller diameter snags. Due to low numbers of inventory plots by snag analysis groups and successional stages by Forest, these ranges are based on all of the eastside wilderness/roadless inventory plots. These snag ranges can provide information on snags to retain in order to maintain ecosystem diversity for the snag resource.

Table 13: Snag Estimates by Seral Stage. Seral stage is based on Stand Size as derived by basal area weighted average diameter: Early-seral = 0.0 – 4.9" average diameter; Mid-seral = 5.0" – 9.9" average diameter; Late-seral = 10.0" + average diameter.

Dominance Type Group	Habitat Type Group	Tree ranges per acre In *Early-seral* Conditions		
		Snags ≥ 10"+ DBH	Snags ≥ 15.0" DBH	Live trees ≥ 15.0" DBH
All Other Groups	Warm	1.2 - 19.5	0.3 - 8.2	0.0 - 0.8
	Cool	17.4 - 46.6	4.2 - 12.3	0.0 - 2.1
	Cold	1.0 - 32.8	0.0 - 6.1	0.0 – 1.1
PICO	All	16.8 - 40.0	2.9 - 10.4	0.0 – 0.4
		Tree ranges per acre In *Mid-seral* Conditions		
		Snags ≥ 10"+ DBH	Snags ≥ 15.0" DBH	Live trees ≥ 15.0" DBH
All Other Groups	Warm	0.7 - 3.9	0.0 - 1.1	1.2 - 3.7
	Cool	6.1 - 14.0	0.3 - 1.7	2.9 - 6.5
	Cold	6.2 - 16.9	1.5 - 6.3	1.0 - 3.1
PICO	All	2.3 – 5.2	0.1 - 0.5	1.6 - 3.0
		Tree ranges per acre In *Late-seral* Conditions		
		Snags ≥ 10"+ DBH	Snags ≥ 15.0" DBH	Live trees ≥ 15.0" DBH
All Other Groups	Warm	3.0 - 6.9	0.8 - 2.2	20.3 - 27.9
	Cool	16.1 - 23.9	4.0 - 6.6	26.3 - 32.7
	Cold	14.8 -26.4	3.6 - 6.5	17.3 - 25.7
PICO	All	11.3 - 21.5	1.9- 5.0	10.1 - 15.9

The ranges given in Table 13, for early-seral areas, can be used in areas of stand replacing fire or insect activity where salvage logging of dead trees is planned or in regeneration harvests in green stands. In areas where intermediate harvests are designed, such as improvement cutting and commercial thinning, the possible ranges for mid-seral or late-seral conditions could be used, as safety guidelines allow. These ranges can be considered based on the target successional stage of the areas that are being treated. If an insufficient number of snags are available for retention, consider compensating by leaving additional large-diameter live trees, which can be recruited, into snags, over time.

Snags are characteristically clumpy (Harris 1999 and table 11) in their distribution, thus, the ranges in Table 13 do not need to be applied to every acre within a treatment area, but should be the average density of snags within the total treatment unit acreage or even the entire project area. Monitoring should be done at the project level during project design and implementation. Using cruise data from the treatment units may be one way to monitor how snags are being considered.

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Appendix A. Overview of Forest Inventory and Analysis (FIA) data and analysis techniques used to produce snag estimates

The national Forest Inventory and Analysis (FIA) program provides a congressionally mandated, statistically-based, continuous inventory of the forest resources of the United States. Since 1930, the FIA program has been administered through the Research and Development branch of the Forest Service, which makes it administratively independent from the National Forest System. The Interior West Forest Inventory and Analysis work unit (IW-FIA), headquartered at the USFS Rocky Mountain Research Station in Ogden, Utah oversees the FIA inventory in Region 1. More information on IW-FIA is available on the internet at: http://www.fs.fed.us/rm/ogden/sitemap/index.shtml.

FIA inventory design is based on a national hexagon of inventory plots. Data is collected on all forested portions of the plots, throughout the United States, regardless of ownership. FIA protocols specify sample plot location within this hexagonal grid. Data collection standards are strictly controlled by FIA protocols. The sample design and data collection methods are scientifically designed, publicly disclosed, and repeatable. Data collection protocols are publicly available on the internet (http://www.fia.fs.fed.us/). There are also stringent quality control standards and procedures, carried out by FIA personnel of the Rocky Mountain Research Station. All of this is designed to assure that data is collected consistently throughout the United States, and that stated accuracy standards are met by the field crews.

To estimate snag density for large areas, such as the Northern Region, individual National Forests, or even large landscape areas, it is infeasible to maintain an inventory for every acre of the millions of acres of forestland. FIA provides a statistically-sound representative sample designed to provide unbiased estimates of forest conditions at broad- and mid-levels. The FIA sampling frame uniformly covers all forested lands, regardless of management emphasis. Therefore, wilderness areas, roadless areas, and actively managed lands all have the same probability of being sampled.

Table 1: Date of Inventory for Eastside National Forests

Eastern Montana Forests	Date of FIA Periodic Inventory
Beaverhead-Deerlodge	1996-1997
Custer	1997
Helena	1996-1998
Gallatin	1997-1998
Lewis & Clark	1996-1997

Using FIA data to assess the density of snags allows the Region to base its monitoring on an unbiased, statistically sound, independently designed and implemented representative sample of forest lands that is remeasured over time. This inventory is current because FIA plots in Region 1 on the eastside Forests were inventoried during 1996 to 1998 (see Table 1 for specific inventory year for eastside Forests). To remain current, FIA is re-measuring 10% of its plots every year. As these re-measured plots accumulate and become available to the Region, snag density estimates will be updated. The snag estimates from FIA contained in this report are

conservative based on the fact that both wildfire and bark beetle infestation has occurred since the date of inventory creating substantially more snags. See Appendix E.

All eastern Montana plots utilized a primary sample unit (PSU) composed of five variable-radius plots with trees 5 inches and larger, in diameter at breast-height (DBH) tallied with a basal area factor of 40.

Analysis Techniques

The R1-FIA Summary Database was used to conduct this analysis. As its name suggests, this database is comprised of several tables of summarized attributes derived from FIA field-collected data. This database has the functionality to compute the mean and confidence intervals for snag density.

Because FIA data comes from a statistical sample rather than a 100% census, attributes calculated from this data are estimates and the accuracy of these estimates can be computed and reported as confidence intervals. To calculate the confidence intervals a technique called "bootstrapping" is used. Bootstrapping is a statistical method that is independent of the distribution of the underlying data. For more information on bootstrapping, see Leach (2002) *A Case Study in the Evaluation of Confidence Interval Algorithms* and Leach (2005) *Bootstrap Calculation of Confidence Intervals for the Estimates of Means by Stratum.*

The Northern Region uses a 90%-confidence interval for describing the reliability of these estimates. The 90% level was chosen to provide a fairly precise level for a biological attribute that can be very variable. It can be thought that if a different set of randomized sample points were collected 100 different times, the estimates of snags would be within the 90%-confidence interval 90% of the time. This also indicates that if every snag on every acre were measured, there is a 90% probability that the true number of snags for the population would be within this confidence interval. Or that 9 out of 10 times, the true population mean is within the confidence interval derived from the sample.

For further information on the R1 FIA Summary Database, see *Overview of R1 FIA Summary Database*, Bush and others (2006).

Appendix B: Initial and Final Habitat Type Groups used in the Eastside Snag Density Analysis.

Habitat type alpha and numeric ADP code are as defined in *Forest Habitat Types of Montana* (Pfister and others 1977).

Final Habitat Type Group	Initial Habitat Type Group	Alpha Code	Numeric ADP Code
Warm	Warm and Very Dry	PIFL	090
		PIFL/AGSP	091
		PIFL/FEID	092
		PIFL/FEID-FEID	093
		PIFL/FEID-FESC	094
		PIFL/JUCO	095
		PIPO	100
		PIPO/AND	110
		PIPO/AGSP	130
		PIPO/FEID	140
		PIPO/FEID-FEID	141
		PIPO/FEID-FESC	142
		PIPO/PUTR	160
		PIPO/PUTR-AGSP	161
		PIPO/PUTR-FEID	162
		PIPO/SYAL	170
		PIPO/SYAL-SYAL	171
		PIPO/SYAL-BERE	172
		PIPO/PRVI	180
		PIPO/PRVI-PRVI	181
		PIPO/PRIVI-SHCA	182
		PIPO/PHMA	190
		PSME/AGSP	210
		PSME/FEID	220
		PSME/FESC	230
		PSME/SYAL-AGSP	311
		PSME/CARU-AGSP	321
		PSME/ARUV	350
		PSME/JUCO	360
		PSME/ARCO	370
		PSME/SYOR	380
	Warm and Dry	PSME/CARU	320
		SME/CARU-ARUV	322
		PSME/CARU-CARU	323
		PSME/CARU-PIPO	324
		PSME/CAGE	330
		PSME/SPBE	340

Final Habitat Type Group	Initial Habitat Type Group	Alpha Code	Numeric ADP Code
Warm	Warm and Dry	PICO/PUTR	910
	Warm and Moist	PSME/VACA	250
		PSME/PHMA	260
		PSME/VAGL-ARUV	282
		PSME/PHMA-PHMA	261
		PSME/PHMA-CARU	262
		PSME/PHMA-SMST	263
		PSME/SYAL	310
		PSME/SYAL-CARU	312
		PSME/SYAL-SYAL	313
		PICEA/PHMA	430
Cool	Cool and Moist	PSME/VAGL	280
		PSME/VAGL-XETE	281
		PSME/VAGL-VAGL	283
		PSME/LIBO	290
		PSME/LIBO-SYAL	291
		PSME/LIBO-CARU	292
		PSME/LIBO-VAGL	293
		PICEA/LIBO	470
		PICEA/SMST	480
		ABLA/LIBO	660
		ABLA/LIBO-LIBO	661
		ABLA/LIBO-XETE	662
		ABLA/LIBO-VASC	663
		PICO/LIBO	930
		PICO/VASC	940
	Cool and Wet	PICEA/EQAR	410
		PICEA/CLUN	420
		PICEA/CLUN-VACA	421
		PICEA/CLUN-CLUN	422
		PICEA/GATR	440
		ABLA/CLUN	620
		ABLA/CLUN-CLUN	621
		ABLA/CLUN-ARNU	622
		ABLA/CLUN-VACA	623
		ABLA/CLUN-XETE	624
		ABLA/CLUN-MEFE	625
		ABLA/GATR	630
		ABLA/CACA	650
		ABLA/CACA-CACA	651
		ABLA/CACA-GATR	653
		ABLA/CACA-VACA	654

Final Habitat Type Group	Initial Habitat Type Group	Alpha Code	Numeric ADP Code
Cool	Cool and Wet	ABLA/CACA-LEGL	655
	Cool and Dry to Moist	PICEA/VACA	450
		ABLA/VACA	640
		ABLA/XETE	690
		ABLA/XETE-VAGL	691
		ABLA/XETE-VASC	692
		TSME/XETE	710
		ABLA/VAGL	720
		ABLA/VASC	730
		ABLA/VASC-CARU	731
		ABLA/VASC-VASC	732
		ABLA/VASC-THOC	733
		PICO/VACA	920
		PICO/VASC	940
		PICO/CARU	950
	Cool and Moist to Wet	ABLA/MEFE	670
		ABLA/ALSI	740
	Warm to Cool and Dry	PICEA/SEST	460
		PICEA/SEST-PSME	461
		PICEA/SEST-PICEA	462
		ABLA/CARU	750
		ABLA/CLPS	770
		ABLA/ARCO	780
		ABLA/CAGE	790
		ABLA/CAGE-CAGE	791
		ABLA/CAGE-PSME	792
Cold	Cold and Dry to Wet	TSME/MEFE	680
		ABLA/RIMO	810
		ABLA-PIAL/VASC	820
		ABLA/LUHI	830
		ABLA/LUHI-VASC	831
		ABLA/LUHI-MEFE	832
		TSME/LUHI	840
		TSME/LUHI-VASC	841
		TSME/LUHI-XETE	842
	Cold and Dry	PIAL-ABLA	850
		PIAL	870
		LALY-ABLA	860
		TIMBERLINE	890

Appendix C: Snag and live tree estimates for all eastside Forests and for each Forest

Table 1: (document section 3.2, table 3) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by initial habitat type groups, for all eastside Forests and for each Forest.

Area	Initial Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Eastside Forests In Wilderness / Roadless	Warm & Very Dry	5.1	2.8	7.9	1.4	0.7	2.3	0.3	0.1	0.6	105	105
	Warm & Dry	5.8	1.8	10.9	1.4	0.5	2.6	0.3	0.0	0.6	44	44
	Warm & Moist	4.7	2.1	7.8	1.1	0.2	2.2	0.3	0.0	0.9	31	31
	Cool & Moist	12.2	7.6	17.5	2.5	1.0	4.3	0.5	0.1	1.0	68	68
	Cool & Dry to Moist	14.0	11.0	17.1	3.0	2.2	4.0	0.6	0.4	0.9	207	207
	Cool & Moist to Wet	16.2	9.8	23.6	2.6	1.3	4.3	0.5	0.1	0.9	36	36
	Warm to Cool & Dry	13.7	8.7	19.4	3.5	2.0	5.3	0.8	0.3	1.4	45	45
	Cool & Wet	18.3	12.0	25.1	5.5	3.2	8.2	1.5	0.5	2.9	39	39
	Cold & Dry to Wet	18.9	14.2	24.1	4.4	3.0	6.1	1.1	0.6	1.6	95	95
	Cold & Dry	11.5	6.8	16.9	3.3	2.0	4.6	1.1	0.6	1.6	60	60
Eastside Forests Outside Wilderness / Roadless	Warm & Very Dry	2.0	1.2	3.1	0.8	0.4	1.2	0.2	0.0	0.3	124	124
	Warm & Dry	3.1	1.5	4.9	0.9	0.3	1.7	0.4	0.1	0.8	53	53
	Warm & Moist	2.5	0.8	4.5	0.4	0.0	1.0	0.2	0.0	0.5	39	39
	Cool & Moist	3.4	1.5	5.5	0.8	0.0	1.8	0.2	0.0	0.4	51	51
	Cool & Dry to Moist	5.2	3.1	7.5	0.8	0.3	1.5	0.1	0.0	0.3	97	97
	Cool & Moist to Wet	6.6	0.0	17.0	1.2	0.0	4.6	0.0	0.0	0.0	5	5
	Warm to Cool & Dry	12.5	6.1	20.0	3.2	1.3	5.6	0.9	0.1	2.0	19	19
	Cool & Wet	6.7	1.5	13.6	1.6	0.0	4.1	0.0	0.0	0.0	15	15
	Cold & Dry to Wet	16.6	5.9	30.4	4.0	1.4	7.0	0.4	0.0	1.1	15	15
	Cold & Dry	11.5	0.0	31.2	2.0	0.0	7.7	0.0	0.0	0.0	5	5

Table 1 continued: (document section 3.2, table 3) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by initial habitat type groups, for all eastside Forests and for each Forest.

Area	Initial Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Beaverhead-Deerlodge In Wilderness / Roadless	Warm & Very Dry	5.6	1.8	10.2	1.6	0.3	3.1	0.5	0.1	1.1	27	27
	Warm & Dry	1.3	0.0	3.0	0.8	0.0	2.1	0.1	0.0	0.3	19	19
	Warm & Moist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	5
	Cool & Moist	5.9	1.7	10.7	1.6	0.0	3.8	0.3	0.0	0.9	13	13
	Cool & Dry to Moist	6.4	4.0	9.2	3.9	1.0	7.5	0.2	0.0	0.4	80	80
	Cool & Moist to Wet	22.8	11.3	36.6	1.2	0.6	2.0	0.8	0.2	1.7	14	14
	Warm to Cool & Dry	21.0	8.8	35.1	3.4	0.7	6.7	0.2	0.0	0.9	15	15
	Cool & Wet	10.7	3.2	20.5	2.9	0.0	6.4	0.4	0.0	1.2	12	12
	Cold & Dry to Wet	22.9	14.8	32.0	6.2	3.4	9.4	1.2	0.4	2.2	39	39
	Cold & Dry	10.6	4.1	18.5	3.6	1.5	6.2	1.4	0.5	2.5	24	24
Beaverhead-Deerlodge Outside Wilderness / Roadless	Warm & Very Dry	1.2	0.2	2.9	0.8	0.2	1.6	0.4	0.1	0.8	37	37
	Warm & Dry	2.7	0.8	5.3	1.0	0.2	2.1	0.4	0.0	1.0	29	29
	Warm & Moist	2.0	0.0	5.7	0.0	0.0	0.0	0.0	0.0	0.0	13	13
	Cool & Moist	1.2	0.0	2.9	0.0	0.0	0.0	0.0	0.0	0.0	26	26
	Cool & Dry to Moist	2.8	1.1	4.8	0.4	0.0	0.9	0.0	0.0	0.1	57	57
	Cool & Moist to Wet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	3
	Warm to Cool & Dry	3.8	0.0	10.2	0.0	0.0	0.0	0.0	0.0	0.0	5	5
	Cool & Wet	9.0	0.0	24.0	2.4	0.0	6.0	0.9	0.0	2.7	6	6
	Cold & Dry to Wet	14.0	3.1	26.3	4.3	0.0	9.5	0.4	0.0	1.5	7	7
	Cold & Dry	11.0	0.0	32.9	0.0	0.0	0.0	0.0	0.0	0.0	3	3

Table 1 continued: (document section 3.2, table 3) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by initial habitat type groups, for all eastside Forests and for each Forest.

Area	Initial Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Custer In Wilderness / Roadless	Warm & Very Dry	6.1	0.0	13.2	1.5	0.0	3.5	0.9	0.0	2.5	10	10
	Warm & Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
	Warm & Moist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4	4
	Cool & Moist										none	
	Cool & Dry to Moist	25.7	8.3	47.1	11.4	2.8	21.0	1.7	0.0	3.6	9	9
	Cool & Moist to Wet										none	
	Warm to Cool & Dry	12.4	0.0	27.1	2.9	0.0	11.5	0.0	0.0	0.0	2	2
	Cool & Wet										none	
	Cold & Dry to Wet	8.4	2.2	15.6	1.7	0.0	4.5	0.9	0.0	2.2	10	10
	Cold & Dry	27.1	0.0	66.9	3.7	0.0	8.6	1.2	0.0	3.4	5	5
Custer Outside Wilderness / Roadless	Warm & Very Dry	2.5	1.0	4.3	0.9	0.3	1.7	0.0	0.0	0.2	52	52
	Warm & Dry	NA			NA			NA			none	
	Warm & Moist	13.3	0.0	26.6	0.0	0.0	0.0	0.0	0.0	0.0	1	1
	Cool & Moist										none	
	Cool & Dry to Moist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	2
	Cool & Moist to Wet										none	
	Warm to Cool & Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
	Cool & Wet	5.4	0.0	10.8	5.4	0.0	10.8	0.0	0.0	0.0	1	1
	Cold & Dry to Wet	15.8	0.0	41.1	3.9	0.0	10.3	0.0	0.0	0.0	3	3
	Cold & Dry										none	

Table 1 continued: (document section 3.2, table 3) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by initial habitat type groups, for all eastside Forests and for each Forest.

Area	Initial Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Gallatin In Wilderness / Roadless	Warm & Very Dry	0.3	0.0	1.2	0.3	0.0	1.2	0.3	0.0	1.2	8	8
	Warm & Dry	10.4	0.6	21.7	6.1	0.0	13.8	1.5	0.0	3.6	5	5
	Warm & Moist	6.4	2.0	11.7	2.4	0.0	5.0	0.8	0.0	2.2	12	12
	Cool & Moist	34.8	16.4	56.5	6.8	2.1	12.5	2.0	0.0	4.9	11	11
	Cool & Dry to Moist	23.7	16.6	31.5	5.9	3.6	8.5	1.0	0.4	1.8	51	51
	Cool & Moist to Wet	9.3	0.0	29.3	1.9	0.0	7.7	0.0	0.0	0.0	2	2
	Warm to Cool & Dry	17.7	9.1	27.3	8.6	3.5	14.7	3.4	0.7	6.8	14	14
	Cool & Wet	18.3	9.8	27.4	3.9	1.4	7.0	1.7	0.3	3.7	11	11
	Cold & Dry to Wet	17.4	10.9	24.8	4.2	2.1	6.8	1.3	0.6	2.1	33	33
	Cold & Dry	10.6	3.2	20.2	3.0	1.2	5.2	1.2	0.4	2.1	20	20
Gallatin Outside Wilderness / Roadless	Warm & Very Dry	0.4	0.0	1.3	0.4	0.0	1.4	0.4	0.0	1.3	6	6
	Warm & Dry	2.0	0.0	6.5	0.8	0.0	2.7	0.1	0.0	0.3	7	7
	Warm & Moist	3.4	0.0	7.7	1.0	0.0	2.6	0.6	0.0	1.6	11	11
	Cool & Moist	8.4	0.0	18.3	3.2	0.0	9.7	0.0	0.0	0.0	7	7
	Cool & Dry to Moist	16.7	3.6	32.1	3.7	0.0	9.2	0.0	0.0	0.0	8	8
	Cool & Moist to Wet	13.8	0.0	27.7	0.0	0.0	0.0	0.0	0.0	0.0	1	1
	Warm to Cool & Dry	11.5	0.0	36.5	4.9	0.0	13.6	0.0	0.0	0.0	4	4
	Cool & Wet	9.9	0.0	25.2	3.9	0.0	8.2	1.7	0.0	5.0	5	5
	Cold & Dry to Wet	3.9	0.0	15.7	3.9	0.0	15.7	1.5	0.0	5.9	2	2
	Cold & Dry	24.9	5.1	45.3	10.2	0.0	20.4	0.0	0.0	0.0	1	1

Table 1 continued: (document section 3.2, table 3) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by initial habitat type groups, for all eastside Forests and for each Forest.

Area	Initial Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Helena In Wilderness / Roadless	Warm & Very Dry	2.6	0.0	6.8	0.8	0.0	2.5	0.2	0.0	0.6	17	17
	Warm & Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	5
	Warm & Moist	10.3	0.0	22.2	0.0	0.0	0.0	0.0	0.0	0.0	5	5
	Cool & Moist	1.8	0.0	5.5	0.4	0.0	1.6	0.0	0.0	0.0	10	10
	Cool & Dry to Moist	13.5	5.2	23.4	0.3	0.0	1.0	0.0	0.0	0.0	2	2
	Cool & Moist to Wet	14.3	0.0	34.4	3.1	0.0	9.4	0.0	0.0	0.1	25	25
	Warm to Cool & Dry	28.1	0.0	54.3	2.3	0.0	9.2	0.0	0.0	0.0	3	3
	Cool & Wet	14.4	0.0	37.3	5.0	0.0	14.0	3.0	0.0	9.0	2	2
	Cold & Dry to Wet	26.8	0.0	59.5	2.7	0.0	6.3	0.6	0.0	1.7	8	8
	Cold & Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	2
Helena Outside Wilderness / Roadless	Warm & Very Dry	2.4	0.0	6.1	0.6	0.0	2.1	0.0	0.0	0.0	11	11
	Warm & Dry	2.9	0.3	6.3	1.2	0.0	3.3	0.6	0.0	1.5	12	12
	Warm & Moist	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	8	8
	Cool & Moist	9.1	0.0	18.7	2.7	0.0	6.7	1.1	0.0	2.8	7	7
	Cool & Dry to Moist	7.0	0.9	14.3	1.3	0.0	3.8	0.4	0.0	1.4	16	16
	Cool & Moist to Wet	19.4	3.1	38.8	6.1	0.0	12.2	0.0	0.0	0.0	1	1
	Warm to Cool & Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
	Cool & Wet	17.9	0.0	36.4	1.1	0.0	4.2	1.1	0.0	4.2	2	2
	Cold & Dry to Wet	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
	Cold & Dry										none	

Table 1 continued: (document section 3.2, table 3) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by initial habitat type groups, for all eastside Forests and for each Forest.

Area	Initial Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
		Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Lewis & Clark In Wilderness / Roadless	Warm & Very Dry	6.5	1.9	12.4	1.8	0.4	3.6	0.2	0.0	0.4	43	43
	Warm & Dry	12.8	1.2	28.1	1.3	0.0	3.3	0.2	0.0	0.8	14	14
	Warm & Moist	3.6	0.0	12.1	1.0	0.0	3.6	0.0	0.0	0.0	5	5
	Cool & Moist	10.4	4.8	17.1	2.0	0.1	5.1	0.3	0.0	0.7	34	34
	Cool & Dry to Moist	14.3	7.3	22.2	2.8	1.3	4.7	1.0	0.2	2.0	42	42
	Cool & Moist to Wet	11.8	4.0	22.5	2.0	0.6	3.8	0.3	0.0	0.9	17	17
	Warm to Cool & Dry	11.5	0.0	26.9	4.3	0.0	9.3	1.5	0.0	4.1	6	6
	Cool & Wet	12.9	4.4	23.7	3.6	1.1	6.7	0.3	0.0	0.8	20	20
	Cold & Dry to Wet	6.7	0.0	17.1	0.0	0.0	0.0	0.0	0.0	0.0	5	5
	Cold & Dry	9.9	2.4	18.9	3.4	0.0	7.4	0.0	0.0	0.0	9	9
Lewis & Clark Outside Wilderness / Roadless	Warm & Very Dry	2.7	0.0	6.4	0.6	0.0	2.0	0.0	0.0	0.0	18	18
	Warm & Dry	7.0	0.0	17.8	0.0	0.0	0.0	0.0	0.0	0.0	5	5
	Warm & Moist	3.3	0.0	9.9	0.9	0.0	3.3	0.0	0.0	0.0	6	6
	Cool & Moist	1.8	0.0	4.9	0.0	0.0	0.0	0.0	0.0	0.0	11	11
	Cool & Dry to Moist	7.0	1.4	15.2	0.4	0.0	1.2	0.4	0.0	1.2	14	14
	Cool & Moist to Wet										none	
	Warm to Cool & Dry	8.7	0.0	20.5	1.2	0.0	4.8	0.0	0.0	0.0	4	4
	Cool & Wet	18.6	3.2	37.1	3.9	0.0	11.5	0.5	0.0	1.8	5	5
	Cold & Dry to Wet	47.8	0.0	124.0	5.2	0.0	14.6	0.0	0.0	0.0	2	2
	Cold & Dry	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1

Table 2a: (document section 3.2, table 5a) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas, by final habitat type groups, for all eastside Forests and for each Forest.

Area		Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Eastern Montana	In Wilderness / Roadless	Warm	5.2	3.4	7.3	1.4	0.8	2.0	0.3	0.2	0.5	180	180
		Cool	14.3	12.2	16.4	3.2	2.6	3.9	0.7	0.5	0.9	395	395
		Cold	16.1	12.6	19.9	4.0	2.9	5.1	1.1	0.7	1.4	155	155
	Outside Wilderness / Roadless	Warm	2.4	1.6	3.2	0.8	0.5	1.1	0.2	0.1	0.3	216	216
		Cool	5.6	4.1	7.2	1.1	0.7	1.7	0.2	0.1	0.4	187	187
		Cold	15.3	6.5	26.2	3.5	1.3	6.1	0.3	0.0	0.8	20	20
Beaverhead Deerlodge	In Wilderness / Roadless	Warm	3.5	1.3	6.0	1.1	0.4	2.1	0.3	0.1	0.6	51	51
		Cool	10.1	7.4	13.0	1.9	1.3	2.7	0.3	0.1	0.5	134	134
		Cold	18.2	12.4	24.6	5.2	3.3	7.4	1.3	0.6	2.0	63	63
	Outside Wilderness / Roadless	Warm	1.9	0.9	3.2	0.8	0.3	1.3	0.3	0.1	0.6	79	79
		Cool	2.7	1.4	4.3	0.4	0.1	0.7	0.1	0.0	0.2	97	97
		Cold	13.1	3.6	24.4	3.0	0.0	6.8	0.3	0.0	1.1	10	10
Custer	In Wilderness / Roadless	Warm	4.1	0.0	8.9	1.0	0.0	2.4	0.6	0.0	1.6	15	15
		Cool	23.3	8.9	41.0	9.8	2.7	17.8	1.4	0.0	3.0	11	11
		Cold	14.6	4.1	28.5	2.4	0.5	4.7	1.0	0.2	2.1	15	15
	Outside Wilderness / Roadless	Warm	2.7	1.2	4.5	0.9	0.3	1.6	0.0	0.0	0.2	53	53
		Cool	1.3	0.0	5.4	1.3	0.0	5.4	0.0	0.0	0.0	4	4
		Cold	15.8	0.0	41.5	3.9	0.0	10.4	0.0	0.0	0.0	3	3

Table 2a continued: (document section 3.2, table 5a) Mean snag density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas, by final habitat type groups, for all eastside Forests and for each Forest.

Area		Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Gallatin	In Wilderness / Roadless	Warm	5.3	2.3	8.7	2.4	0.8	4.4	0.8	0.2	1.6	25	25
		Cool	23.2	18.1	28.6	6.1	4.4	8.0	1.6	0.9	2.4	89	89
		Cold	14.8	9.7	20.6	3.8	2.3	5.5	1.2	0.7	1.8	53	53
	Outside Wilderness / Roadless	Warm	2.2	0.5	4.5	0.8	0.1	1.7	0.4	0.0	0.9	24	24
		Cool	12.0	6.0	18.9	3.6	1.4	6.3	0.3	0.0	1.0	25	25
		Cold	10.9	0.0	27.1	6.0	0.0	15.7	1.0	0.0	2.9	3	3
Helena	In Wilderness / Roadless	Warm	3.5	0.8	7.0	0.5	0.0	1.5	0.1	0.0	0.4	27	27
		Cool	11.5	6.0	18.0	0.8	0.2	1.7	0.2	0.0	0.5	42	42
		Cold	21.5	0.0	48.4	2.2	0.0	5.1	0.5	0.0	1.4	10	10
	Outside Wilderness / Roadless	Warm	2.0	0.6	3.8	0.7	0.0	1.6	0.2	0.0	0.6	31	31
		Cool	8.6	4.1	13.7	1.8	0.4	3.6	0.6	0.1	1.3	27	27
		Cold	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
Lewis & Clark	In Wilderness / Roadless	Warm	7.6	3.3	12.9	1.6	0.5	3.0	0.2	0.0	0.4	62	62
		Cool	12.4	8.8	16.5	2.7	1.6	3.9	0.6	0.3	1.0	119	119
		Cold	8.8	3.2	15.2	2.2	0.0	4.8	0.0	0.0	0.0	14	14
	Outside Wilderness / Roadless	Warm	3.6	1.1	6.6	0.6	0.0	1.5	0.0	0.0	0.0	29	29
		Cool	7.2	3.4	11.8	0.9	0.1	2.1	0.2	0.0	0.6	34	34
		Cold	31.9	0.0	94.3	3.5	0.0	10.4	0.0	0.0	0.0	3	3

Table 2b: (document section 3.2, table 5b) Mean live tree density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by final habitat type groups, for all eastside Forests and for each Forest.

Area		Habitat Type Group	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Eastern Montana	In Wilderness / Roadless	Warm	49.2	43.3	55.2	13.6	11.3	16.0	3.9	2.9	4.9	180	180
		Cool	57.9	53.4	62.6	11.7	10.3	13.2	2.6	2.1	3.1	395	395
		Cold	59.1	51.8	66.9	11.3	9.0	13.8	2.7	2.0	3.6	155	155
	Outside Wilderness / Roadless	Warm	48.6	43.6	53.7	11.5	9.7	13.4	3.0	2.3	3.8	216	216
		Cool	50.2	43.8	56.7	8.0	6.3	9.9	1.6	1.1	2.2	187	187
		Cold	56.7	35.5	80.1	13.6	6.6	21.5	3.6	1.2	6.5	20	20
Beaverhead Deerlodge	In Wilderness / Roadless	Warm	62.7	52.2	73.7	21.9	16.8	27.2	7.7	5.3	10.5	51	51
		Cool	63.4	55.7	71.3	12.4	9.9	15.1	2.5	1.9	3.3	134	134
		Cold	61.6	51.8	71.6	12.4	8.8	16.5	4.2	2.7	5.9	63	63
	Outside Wilderness / Roadless	Warm	57.1	49.4	65.1	11.5	8.9	14.4	3.6	2.4	5.1	79	79
		Cool	45.5	37.8	53.4	6.3	4.5	8.2	1.1	0.6	1.6	97	97
		Cold	40.8	17.2	70.4	5.6	1.2	11.2	0.8	0.0	2.2	10	10
Custer	In Wilderness / Roadless	Warm	36.4	18.5	58.5	8.8	3.4	15.3	1.2	0.2	2.4	15	15
		Cool	30.1	11.5	51.2	6.8	0.1	15.9	1.7	0.1	3.9	11	11
		Cold	65.7	41.7	92.1	10.9	4.1	18.7	2.9	0.2	6.1	15	15
	Outside Wilderness / Roadless	Warm	27.4	20.7	34.8	6.7	4.3	9.3	1.1	0.5	1.9	53	53
		Cool	27.3	0.0	61.0	7.8	0.0	17.4	0.0	0.0	0.0	4	4
		Cold	83.9	0.0	141.4	29.9	0.0	54.9	8.0	0.0	16.5	3	3

Table 2b continued: (document section 3.2, table 5b) Mean live tree density per acre and 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas by final habitat type groups, for all eastside Forests and for each Forest.

Area		Habitat Type Group	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound	Mean	90% CI - Lower Bound	90% CI - Upper Bound		
Gallatin	In Wilderness / Roadless	Warm	45.7	30.8	62.4	14.8	9.5	20.6	3.9	1.8	6.3	25	25
		Cool	69.0	59.3	79.1	18.1	14.6	21.8	4.9	3.4	6.5	89	89
		Cold	64.7	50.0	80.5	13.2	8.9	18.0	2.1	1.2	3.0	53	53
	Outside Wilderness / Roadless	Warm	40.4	28.5	53.3	16.8	10.8	23.5	5.7	2.9	9.1	24	24
		Cool	50.2	34.8	66.2	12.7	7.3	18.7	3.5	1.3	5.9	25	25
		Cold	40.6	6.6	78.8	22.3	0.0	48.7	11.6	0.0	25.0	3	3
Helena	In Wilderness / Roadless	Warm	51.9	35.0	70.9	12.5	6.6	19.3	3.3	1.5	5.3	27	27
		Cool	36.2	26.5	46.4	6.1	3.6	9.1	0.9	0.3	1.6	42	42
		Cold	40.7	23.9	59.0	2.7	0.0	5.6	0.4	0.0	1.3	10	10
	Outside Wilderness / Roadless	Warm	60.6	45.3	77.0	16.6	10.9	22.7	3.8	2.0	5.8	31	31
		Cool	62.9	39.7	88.1	9.5	3.3	17.4	2.2	0.4	4.4	27	27
		Cold	47.0	16.8	77.2	0.0	0.0	0.0	0.0	0.0	0.0	1	1
Lewis & Clark	In Wilderness / Roadless	Warm	41.3	32.1	51.0	7.9	4.9	11.3	1.6	0.7	2.7	62	62
		Cool	53.6	44.8	62.7	8.6	6.3	11.2	1.7	1.0	2.5	119	119
		Cold	33.0	10.3	59.4	5.5	0.3	13.6	0.2	0.0	0.8	14	14
	Outside Wilderness / Roadless	Warm	57.6	40.6	75.5	10.6	4.9	17.1	1.8	0.6	3.1	29	29
		Cool	56.4	40.4	73.1	8.5	4.5	13.2	1.4	0.2	2.9	34	34
		Cold	101.8	0.0	188.2	19.9	0.0	52.8	1.6	0.0	5.0	3	3

Table 3a: (document section 3.4, Table 7a) Mean snag density per acre with 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type group; for all eastside Forests and for each Forest.

Area	Area	Dominance Group	Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Eastside Forests	In Wilderness / Roadless	All Other Groups	Warm	4.4	3.0	6.1	1.4	0.8	2.1	0.4	0.2	0.6	152	152
			Cool	18.5	15.4	21.7	4.4	3.5	5.3	1.1	0.8	1.5	201	201
			Cold	16.5	12.7	20.7	4.3	3.2	5.6	1.2	0.8	1.6	136	136
		PICO	All	10.1	7.8	12.6	1.9	1.2	2.6	0.2	0.1	0.4	243	243
	Outside Wilderness / Roadless	All Other Groups	Warm	2.4	1.6	3.3	0.9	0.5	1.2	0.3	0.1	0.4	177	177
			Cool	10.5	7.2	14.1	2.5	1.3	3.7	0.6	0.2	1.0	63	63
			Cold	20.1	8.5	34.6	5.0	2.1	8.4	0.4	0.0	1.2	14	14
		PICO	All	2.9	1.8	4.2	0.4	0.2	0.8	0.0	0.0	0.1	169	169
Beaverhead-Deerlodge	In Wilderness / Roadless	All Other Groups	Warm	4.2	1.6	7.3	1.3	0.4	2.4	0.4	0.1	0.8	41	41
			Cool	18.7	13.0	24.9	3.7	2.3	5.4	0.6	0.3	1.1	49	49
			Cold	20.4	13.7	27.9	6.0	3.7	8.6	1.5	0.8	2.4	52	52
		PICO	All	5.1	3.2	7.2	1.0	0.5	1.6	0.1	0.0	0.2	107	107
	Outside Wilderness / Roadless	All Other Groups	Warm	1.9	0.6	3.6	0.9	0.3	1.6	0.5	0.2	0.9	52	52
			Cool	6.5	2.8	11.0	1.1	0.2	2.2	0.3	0.0	0.8	25	25
			Cold	17.7	4.1	33.2	5.1	0.0	11.0	0.5	0.0	1.8	6	6
		PICO	All	1.7	0.7	2.9	0.2	0.0	0.5	0.0	0.0	0.1	103	103
Custer	In Wilderness / Roadless	All Other Groups	Warm	4.7	0.0	10.3	1.2	0.0	2.7	0.7	0.0	1.9	13	13
			Cool	23.2	5.8	46.8	8.8	1.4	17.3	1.2	0.0	2.8	8	8
			Cold	15.9	4.0	32.0	2.8	0.6	5.4	1.2	0.2	2.4	13	13
		PICO	All	11.9	0.0	25.6	5.3	0.0	15.8	0.9	0.0	3.0	7	7
	Outside Wilderness / Roadless	All Other Groups	Warm	2.5	1.0	4.3	0.9	0.3	1.7	0.0	0.0	0.2	52	52
			Cool	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			Cold	15.8	0.0	41.9	3.9	0.0	10.4	0.0	0.0	0.0	3	3
		PICO	All	4.7	0.0	13.3	1.3	0.0	5.4	0.0	0.0	0.0	4	4

Table 3a continued: (document section 3.4, Table 7a) Mean snag density per acre with 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type group; for all eastside Forests and for each Forest.

Area	Area	Dominance Group	Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Gallatin	In Wilderness / Roadless	All Other Groups	Warm	5.3	2.3	8.7	2.4	0.8	4.4	0.8	0.2	1.6	25	25
			Cool	26.6	19.8	34.0	7.2	5.0	9.6	2.2	1.2	3.3	59	59
			Cold	13.6	8.6	19.3	4.0	2.4	5.9	1.4	0.8	2.1	47	47
		PICO	All	17.4	11.2	24.2	3.6	1.5	6.0	0.3	0.0	1.0	37	37
	Outside Wilderness / Roadless	All Other Groups	Warm	2.7	0.6	5.3	0.9	0.1	2.0	0.4	0.0	1.1	20	20
			Cool	19.0	9.0	30.2	4.6	1.3	8.7	0.6	0.0	1.9	13	13
			Cold	16.4	0.0	35.1	9.0	0.0	20.4	1.5	0.0	5.9	2	2
		PICO	All	3.2	0.0	7.4	1.8	0.0	4.6	0.0	0.0	0.0	17	17
Helena	In Wilderness / Roadless	All Other Groups	Warm	3.6	0.6	7.5	0.6	0.0	1.8	0.1	0.0	0.4	23	23
			Cool	17.3	5.5	31.3	2.1	0.0	4.9	0.7	0.0	2.1	9	9
			Cold	21.5	0.0	48.5	2.2	0.0	5.1	0.5	0.0	1.4	10	10
		PICO	All	9.2	3.7	15.8	0.4	0.0	1.2	0.0	0.0	0.1	37	37
	Outside Wilderness / Roadless	All Other Groups	Warm	2.1	0.6	4.1	0.7	0.0	1.7	0.3	0.0	0.6	29	29
			Cool	11.8	4.9	19.3	3.8	0.7	7.8	1.5	0.3	3.1	11	11
			Cold										none	
		PICO	All	5.4	0.0	11.5	0.3	0.0	1.2	0.0	0.0	0.0	19	19
Lewis & Clark	In Wilderness / Roadless	All Other Groups	Warm	4.6	1.6	8.4	1.4	0.3	2.9	0.2	0.0	0.5	50	50
			Cool	11.6	7.8	15.9	2.4	1.5	3.5	0.7	0.3	1.2	76	76
			Cold	8.8	3.2	15.2	2.2	0.0	4.9	0.0	0.0	0.0	14	14
		PICO	All	15.4	8.4	23.1	3.0	1.1	5.3	0.4	0.0	0.9	55	55
	Outside Wilderness / Roadless	All Other Groups	Warm	3.4	0.8	6.7	0.7	0.0	1.8	0.0	0.0	0.0	24	24
			Cool	9.3	2.7	17.5	2.1	0.0	5.1	0.4	0.0	1.1	13	13
			Cold	31.9	0.0	94.9	3.5	0.0	10.9	0.0	0.0	0.0	3	3
		PICO	All	5.6	1.9	10.5	0.1	0.0	0.5	0.1	0.0	0.5	26	26

Table 3b: (document section 3.4, table 7b) Mean live tree density per acre with 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type group; for all eastside Forests and for each Forest.

Area	Area	Dominance Group	Habitat Type Group	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Eastside Forests	In Wilderness / Roadless	All Other Groups	Warm	51.3	44.8	58.1	15.1	12.5	17.9	4.4	3.4	5.6	152	152
			Cool	66.4	60.2	72.8	18.8	16.4	21.3	4.6	3.8	5.5	201	201
			Cold	57.5	49.8	65.4	12.4	9.8	15.2	3.1	2.2	4.0	136	136
		PICO	All	49.3	43.4	55.3	4.4	3.5	5.4	0.6	0.4	0.8	243	243
	Outside Wilderness / Roadless	All Other Groups	Warm	48.1	42.7	53.8	13.2	11.2	15.4	3.5	2.7	4.4	177	177
			Cool	65.0	52.8	77.4	16.8	12.7	21.2	3.9	2.5	5.3	63	63
			Cold	69.1	39.9	100.1	18.7	9.2	28.9	5.1	1.8	9.0	14	14
		PICO	All	44.0	38.0	50.3	3.6	2.6	4.6	0.5	0.2	0.9	169	169
Beaverhead-Deerlodge	In Wilderness / Roadless	All Other Groups	Warm	68.0	56.0	80.6	25.4	19.5	31.6	9.3	6.4	12.5	41	41
			Cool	76.4	64.8	88.5	25.6	20.6	30.9	5.9	4.4	7.4	49	49
			Cold	63.4	52.2	75.1	14.6	10.3	19.3	4.9	3.2	6.9	52	52
		PICO	All	54.0	45.8	62.7	4.8	3.4	6.3	0.7	0.4	1.1	107	107
	Outside Wilderness / Roadless	All Other Groups	Warm	59.9	50.4	69.7	15.2	11.6	19.0	5.1	3.3	7.1	52	52
			Cool	54.3	39.5	70.3	14.5	9.9	19.5	3.4	2.0	4.9	25	25
			Cold	49.9	14.4	97.2	7.7	0.0	16.5	1.4	0.0	3.7	6	6
		PICO	All	44.3	37.1	51.9	3.7	2.5	5.0	0.4	0.1	0.9	103	103
Custer	In Wilderness / Roadless	All Other Groups	Warm	38.6	18.0	63.9	9.0	2.9	16.2	1.3	0.2	2.8	13	13
			Cool	41.4	17.7	66.8	9.3	0.2	21.5	2.3	0.2	5.3	8	8
			Cold	71.6	44.9	101.2	12.6	5.0	21.3	3.3	0.3	6.9	13	13
		PICO	All	14.2	0.0	28.5	2.2	0.0	6.6	0.0	0.0	0.0	7	7
	Outside Wilderness / Roadless	All Other Groups	Warm	26.5	19.7	33.7	6.8	4.4	9.5	1.2	0.5	1.9	52	52
			Cool	63.6	35.4	90.8	14.3	5.7	21.9	0.0	0.0	0.0	1	1
			Cold	83.9	0.0	141.4	29.9	0.0	54.5	8.0	0.0	16.5	3	3
		PICO	All	31.0	0.0	70.6	4.2	0.0	14.1	0.0	0.0	0.0	4	4

Table 3b: (document section 3.4, table 7b) Mean live tree density per acre with 90% confidence interval, by diameter class, inside and outside of wilderness/roadless areas for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type group; for all eastside Forests and for each Forest.

Area	Area	Dominance Group	Habitat Type Group	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
Gallatin	In Wilderness / Roadless	All Other Groups	Warm	45.7	30.7	62.4	14.8	9.5	20.6	3.9	1.8	6.3	25	25
			Cool	73.9	62.7	85.2	24.1	19.5	28.8	7.0	4.9	9.2	59	59
			Cold	58.0	43.4	73.6	14.0	9.3	19.4	2.3	1.4	3.3	47	47
		PICO	All	67.8	49.6	87.6	6.5	3.9	9.4	0.7	0.2	1.4	37	37
	Outside Wilderness / Roadless	All Other Groups	Warm	46.1	33.3	59.9	19.2	12.3	26.8	6.5	3.2	10.3	20	20
			Cool	55.0	35.7	75.4	14.6	6.5	24.1	4.3	1.0	8.3	13	13
			Cold	55.0	13.2	89.5	33.4	0.0	57.9	17.4	0.0	30.6	2	2
		PICO	All	35.2	16.9	55.5	8.6	3.5	14.5	2.2	0.4	4.6	17	17
Helena	In Wilderness / Roadless	All Other Groups	Warm	52.5	33.3	74.4	13.8	7.1	21.7	3.6	1.5	6.0	23	23
			Cool	53.8	35.1	73.7	15.0	6.4	24.5	2.6	0.6	5.0	9	9
			Cold	40.7	23.9	59.3	2.7	0.0	5.7	0.4	0.0	1.3	10	10
		PICO	All	33.2	23.0	44.2	3.9	2.0	6.0	0.5	0.1	1.1	37	37
	Outside Wilderness / Roadless	All Other Groups	Warm	56.6	41.9	72.5	17.5	11.5	23.9	4.1	2.2	6.1	29	29
			Cool	92.1	48.1	139.4	22.1	8.3	39.4	5.1	0.6	10.2	11	11
			Cold										none	
		PICO	All	51.0	29.1	75.3	1.0	0.0	2.2	0.2	0.0	0.6	19	19
Lewis & Clark	In Wilderness / Roadless	All Other Groups	Warm	43.1	33.0	53.8	9.0	5.4	13.1	1.9	0.9	3.2	50	50
			Cool	58.4	47.7	69.6	11.9	8.5	15.5	2.5	1.5	3.7	76	76
			Cold	33.0	10.3	59.4	5.5	0.3	13.5	0.2	0.0	0.8	14	14
		PICO	All	42.8	30.6	55.8	3.0	1.5	4.6	0.3	0.0	0.6	55	55
	Outside Wilderness / Roadless	All Other Groups	Warm	61.1	42.3	80.9	12.8	6.1	20.4	2.1	0.8	3.6	24	24
			Cool	72.6	45.5	100.6	19.0	9.9	29.1	3.6	0.7	7.3	13	13
			Cold	101.8	0.0	187.8	19.9	0.0	52.8	1.6	0.0	4.9	3	3
		PICO	All	45.3	27.9	63.9	1.6	0.4	3.1	0.0	0.0	0.0	26	26

Table 4a: (document section 3.6, table 8a) Mean snag density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Eastside Forests In Wilderness / Roadless	All Other Groups	Warm	0-4.9	8.7	1.2	19.5	3.6	0.3	8.2	0.8	0.0	1.9	16	16
			5-9.9	2.2	0.7	3.9	0.5	0.0	1.1	0.3	0.0	0.7	45	45
			10+	4.8	3.0	6.9	1.5	0.8	2.2	0.4	0.2	0.6	91	91
		Cool	0-4.9	31.3	17.4	46.4	8.0	4.2	12.3	1.8	0.3	3.7	25	25
			5-9.9	9.8	6.1	14.0	0.9	0.3	1.7	0.3	0.0	0.6	57	57
			10+	19.9	16.1	23.9	5.2	4.0	6.6	1.4	0.9	1.9	119	119
		Cold	0-4.9	15.4	1.0	32.8	2.8	0.0	6.1	0.7	0.0	1.6	13	13
			5-9.9	11.1	6.2	16.9	3.7	1.5	6.3	1.2	0.5	2.1	49	49
			10+	20.3	14.8	26.4	5.0	3.6	6.5	1.3	0.8	1.9	74	74
	PICO	All	0-4.9	28.0	16.8	40.0	6.4	2.9	10.4	1.1	0.3	2.2	35	35
			5-9.9	3.7	2.3	5.2	0.3	0.1	0.5	0.0	0.0	0.0	151	151
			10+	16.2	11.3	21.5	3.3	1.9	5.0	0.2	0.0	0.5	57	57
Eastside Forests Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9	8.7	1.2	19.5	3.6	0.3	8.2	0.8	0.0	1.9	16	16
			5-9.9	2.2	0.7	3.9	0.5	0.0	1.1	0.3	0.0	0.7	45	45
			10+	4.8	3.0	6.9	1.5	0.8	2.2	0.4	0.2	0.6	91	91
		Cool	0-4.9	31.3	17.4	46.4	8.0	4.2	12.3	1.8	0.3	3.7	25	25
			5-9.9	9.8	6.1	14.0	0.9	0.3	1.7	0.3	0.0	0.6	57	57
			10+	19.9	16.1	23.9	5.2	4.0	6.6	1.4	0.9	1.9	119	119
		Cold	0-4.9	15.4	1.0	32.8	2.8	0.0	6.1	0.7	0.0	1.6	13	13
			5-9.9	11.1	6.2	16.9	3.7	1.5	6.3	1.2	0.5	2.1	49	49
			10+	20.3	14.8	26.4	5.0	3.6	6.5	1.3	0.8	1.9	74	74
	PICO	All	0-4.9	28.0	16.8	40.0	6.4	2.9	10.4	1.1	0.3	2.2	35	35
			5-9.9	3.7	2.3	5.2	0.3	0.1	0.5	0.0	0.0	0.0	151	151
			10+	16.2	11.3	21.5	3.3	1.9	5.0	0.2	0.0	0.5	57	57

Table 4a continued: (document section 3.6, table 8a) Mean snag density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
Beaverhead-Deerlodge In Wilderness / Roadless	All Other Groups	Warm	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	5
			10+	4.9	1.8	8.5	1.5	0.4	2.8	0.4	0.1	0.9	35	35
		Cool	0-4.9										none	
			5-9.9	15.3	4.7	27.4	1.4	0.0	4.1	0.5	0.0	1.7	7	7
			10+	19.3	12.9	26.5	4.1	2.4	6.0	0.7	0.3	1.1	42	42
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	19.7	6.3	35.8	6.7	1.0	14.5	2.4	0.4	5.2	14	14
			10+	22.4	14.3	31.7	6.2	3.9	8.7	1.3	0.6	2.2	35	35
	PICO	All	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4	4
			5-9.9	3.8	2.0	6.1	0.3	0.1	0.7	0.0	0.0	0.0	79	79
			10+	10.0	5.0	15.9	3.3	1.3	5.7	0.4	0.0	1.1	24	24
Beaverhead-Deerlodge Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9										none	
			5-9.9	2.6	0.0	8.4	1.2	0.0	3.3	0.6	0.0	1.8	10	10
			10+	1.8	0.5	3.5	0.8	0.2	1.6	0.5	0.1	0.9	42	42
		Cool	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	3.7	0.0	10.7	0.0	0.0	0.0	0.0	0.0	0.0	7	7
			10+	9.1	3.6	15.9	1.8	0.3	3.6	0.5	0.0	1.3	15	15
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	16.8	0.0	44.2	6.5	0.0	20.3	1.5	0.0	5.8	2	2
			10+	24.1	6.2	48.4	5.7	0.0	13.3	0.0	0.0	0.0	3	3
	PICO	All	0-4.9	0.5	0.0	1.7	0.0	0.0	0.0	0.0	0.0	0.0	21	21
			5-9.9	1.6	0.3	3.3	0.3	0.0	0.7	0.0	0.0	0.0	62	62
			10+	3.2	0.6	6.5	0.4	0.0	1.3	0.1	0.0	0.3	20	20

Table 4a continued: (document section 3.6, table 8a) Mean snag density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI-Lower Bound	90% CI – Upper Bound	Mean	90% CI-Lower Bound	90% CI – Upper Bound	Mean	90% CI-Lower Bound	90% CI – Upper Bound		
Custer In Wilderness / Roadless	All Other Groups	Warm	0-4.9	21.5	8.4	36.3	2.8	0.0	5.6	2.8	0.0	5.6	1	1
			5-9.9	1.1	0.0	3.4	1.1	0.0	3.4	1.1	0.0	3.4	6	6
			10+	5.5	0.0	15.9	1.0	0.0	3.6	0.0	0.0	0.0	6	6
		Cool	0-4.9	51.1	0.0	123.9	15.5	0.0	38.4	1.2	0.0	4.9	2	2
			5-9.9	14.2	0.0	30.0	1.9	0.0	5.7	0.0	0.0	0.0	3	3
			10+	13.5	0.0	31.6	11.3	0.0	25.2	2.4	0.0	6.0	3	3
		Cold	0-4.9	109.2	72.2	145.9	6.8	1.4	12.5	2.9	0.0	5.7	1	1
			5-9.9	3.6	0.0	10.5	0.5	0.0	1.7	0.5	0.0	1.7	7	7
			10+	14.4	2.2	27.2	5.1	0.0	11.1	1.8	0.0	4.1	5	5
	PICO	All	0-4.9	23.4	0.0	50.6	12.5	0.0	36.6	2.1	0.0	6.2	3	3
			5-9.9	3.2	0.0	12.8	0.0	0.0	0.0	0.0	0.0	0.0	4	4
			10+										none	
Custer Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9	5.5	1.7	10.2	2.3	0.6	4.4	0.2	0.0	0.6	16	16
			5-9.9	0.8	0.0	2.8	0.0	0.0	0.0	0.0	0.0	0.0	11	11
			10+	1.4	0.0	3.4	0.5	0.0	1.3	0.0	0.0	0.0	25	25
		Cool	0-4.9										none	
			5-9.9										none	
			10+	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9										none	
			10+	23.7	0.0	51.6	5.8	0.0	12.9	0.0	0.0	0.0	2	2
	PICO	All	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	6.2	0.0	16.9	1.8	0.0	5.4	0.0	0.0	0.0	3	3
			10+										none	

Table 4a continued: (document section 3.6, table 8a) Mean snag density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
Gallatin In Wilderness / Roadless	All Other Groups	Warm	0-4.9	3.5	0.0	10.4	3.5	0.0	10.4	2.2	0.0	6.6	3	3
			5-9.9	4.2	0.0	10.4	1.5	0.0	4.7	0.4	0.0	1.7	8	8
			10+	6.3	2.0	11.4	2.7	0.3	5.7	0.7	0.0	1.6	14	14
		Cool	0-4.9	56.1	21.3	94.2	17.8	8.4	28.0	4.5	0.0	11.4	6	6
			5-9.9	16.6	0.9	35.7	0.0	0.0	0.0	0.0	0.0	0.0	10	10
			10+	24.9	18.1	32.3	7.4	4.9	10.1	2.3	1.3	3.6	43	43
		Cold	0-4.9	18.3	0.0	39.8	5.9	0.0	13.8	1.2	0.0	3.2	5	5
			5-9.9	10.0	3.0	18.9	4.8	1.2	9.8	1.3	0.2	2.6	14	14
			10+	14.6	7.9	22.7	3.3	1.7	5.2	1.5	0.7	2.4	28	28
	PICO	All	0-4.9	24.5	4.1	45.6	10.4	0.0	22.9	3.2	0.0	8.5	4	4
			5-9.9	6.7	1.6	13.3	1.0	0.0	2.7	0.0	0.0	0.0	17	17
			10+	27.0	15.9	39.7	4.5	0.9	9.1	0.0	0.0	0.0	16	16
Gallatin Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9										none	
			5-9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	2
			10+	3.0	0.7	5.9	1.0	0.1	2.2	0.5	0.0	1.2	18	18
		Cool	0-4.9	21.4	0.0	58.6	2.3	0.0	9.3	0.0	0.0	0.0	2	2
			5-9.9	21.1	0.0	53.0	6.5	0.0	19.6	0.0	0.0	0.0	3	3
			10+	17.6	6.5	30.9	4.4	0.7	9.2	1.0	0.0	3.2	8	8
		Cold	0-4.9										none	
			5-9.9										none	
			10+	16.4	0.0	35.1	9.0	0.0	20.4	1.5	0.0	5.9	2	2
	PICO	All	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4	4
			5-9.9	2.3	0.0	7.5	0.7	0.0	2.6	0.0	0.0	0.0	8	8
			10+	7.3	0.0	19.6	5.2	0.0	14.1	0.0	0.0	0.0	5	5

Table 4a continued: (document section 3.6, table 8a) Mean snag density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI-Lower Bound	90% CI – Upper Bound	Mean	90% CI-Lower Bound	90% CI – Upper Bound	Mean	90% CI-Lower Bound	90% CI – Upper Bound		
Helena In Wilderness / Roadless	All Other Groups	Warm	0-4.9	10.4	0.0	20.7	10.4	0.0	20.7	0.0	0.0	0.0	1	1
			5-9.9	2.0	0.0	7.0	0.0	0.0	0.0	0.0	0.0	0.0	7	7
			10+	3.9	0.1	9.3	0.2	0.0	0.6	0.2	0.0	0.6	15	15
		Cool	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	12.6	2.3	24.2	2.0	0.0	6.7	1.2	0.0	3.8	5	5
			10+	30.7	0.0	67.2	2.9	0.0	7.6	0.0	0.0	0.0	3	3
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	8.1	0.0	24.3	1.2	0.0	4.2	0.4	0.0	1.5	7	7
			10+	79.0	17.6	162.9	6.7	0.0	13.5	0.9	0.0	3.6	2	2
	PICO	All	0-4.9	25.2	5.8	48.5	0.8	0.0	2.7	0.1	0.0	0.4	9	9
			5-9.9	3.5	0.6	7.2	0.0	0.0	0.0	0.0	0.0	0.0	23	23
			10+	6.8	0.0	20.5	1.9	0.0	7.1	0.0	0.0	0.0	5	5
Helena Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9	3.2	0.0	12.9	3.2	0.0	12.9	0.0	0.0	0.0	2	2
			5-9.9	1.7	0.0	6.8	0.0	0.0	0.0	0.0	0.0	0.0	8	8
			10+	2.2	0.4	4.5	0.8	0.0	2.1	0.4	0.0	1.0	19	19
		Cool	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	2
			5-9.9	2.3	0.0	9.4	2.3	0.0	9.4	0.0	0.0	0.0	2	2
			10+	17.8	8.6	27.6	5.3	0.8	11.3	2.4	0.5	4.7	7	7
		Cold	0-4.9										none	
			5-9.9										none	
			10+										none	
	PICO	All	0-4.9	20.5	0.0	44.9	2.0	0.0	6.1	0.0	0.0	0.0	3	3
			5-9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14	14
			10+	20.2	0.0	52.8	0.0	0.0	0.0	0.0	0.0	0.0	2	2

Table 4a continued: (document section 3.6, table 8a) Mean snag density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Lewis & Clark In Wilderness / Roadless	All Other Groups	Warm	0-4.9	9.7	0.0	27.0	3.5	0.0	10.3	0.4	0.0	1.4	10	10
			5-9.9	2.2	0.0	5.2	0.1	0.0	0.5	0.1	0.0	0.6	19	19
			10+	4.2	1.2	8.1	1.6	0.3	3.2	0.2	0.0	0.5	21	21
		Cool	0-4.9	21.5	7.5	37.7	3.9	1.1	7.6	1.0	0.0	2.7	16	16
			5-9.9	5.6	2.7	8.9	0.9	0.2	1.8	0.2	0.0	0.5	32	32
			10+	12.8	7.6	18.7	3.2	1.7	4.9	1.1	0.3	2.1	28	28
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	6.7	0.0	14.9	0.9	0.0	3.2	0.0	0.0	0.0	7	7
			10+	19.0	4.1	33.7	5.9	0.0	13.7	0.0	0.0	0.0	4	4
	PICO	All	0-4.9	38.9	17.6	61.7	9.1	2.7	16.8	1.3	0.0	3.3	15	15
			5-9.9	1.6	0.0	4.4	0.0	0.0	0.0	0.0	0.0	0.0	28	28
			10+	18.0	6.3	31.9	2.3	0.4	4.6	0.0	0.0	0.0	12	12
Lewis & Clark Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	3.2	0.0	8.9	0.0	0.0	0.0	0.0	0.0	0.0	8	8
			10+	4.4	0.3	9.6	1.3	0.0	3.4	0.0	0.0	0.0	13	13
		Cool	0-4.9										none	
			5-9.9	4.3	0.0	11.2	0.8	0.0	3.0	0.0	0.0	0.0	6	6
			10+	13.6	2.1	27.7	3.1	0.0	8.7	0.7	0.0	2.0	7	7
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			10+	95.6	47.4	150.1	10.4	2.1	18.8	0.0	0.0	0.0	1	1
	PICO	All	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	5
			5-9.9	3.2	0.3	7.0	0.2	0.0	0.8	0.2	0.0	0.8	16	16
			10+	18.9	4.6	39.7	0.0	0.0	0.0	0.0	0.0	0.0	5	5

Table 4b: (document section 3.6, table 8b) Mean live tree density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for final snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
Eastside Forests In Wilderness / Roadless	All Other Groups	Warm	0-4.9	1.3	0.0	3.3	0.2	0.0	0.8	0.2	0.0	0.8	16	16
			5-9.9	32.3	24.4	40.7	2.3	1.2	3.7	0.1	0.0	0.4	45	45
			10+	69.5	60.7	78.5	24.1	20.3	27.9	7.3	5.7	9.0	91	91
		Cool	0-4.9	0.9	0.0	2.1	0.9	0.0	2.1	0.1	0.0	0.5	25	25
			5-9.9	52.6	43.5	62.0	4.6	2.9	6.5	0.7	0.3	1.2	57	57
			10+	86.9	79.2	94.8	29.4	26.3	32.7	7.5	6.2	8.8	119	119
		Cold	0-4.9	1.4	0.0	4.4	0.3	0.0	1.1	0.0	0.0	0.0	13	13
			5-9.9	35.8	27.4	44.7	2.0	1.0	3.1	0.3	0.1	0.6	49	49
			10+	81.8	70.7	93.3	21.4	17.3	25.7	5.4	4.0	7.0	74	74
	PICO	All	0-4.9	0.6	0.0	1.6	0.1	0.0	0.4	0.0	0.0	0.0	35	35
			5-9.9	44.0	38.1	50.1	2.3	1.6	3.0	0.1	0.0	0.2	151	151
			10+	93.1	78.9	108.0	12.8	10.1	15.6	2.3	1.5	3.1	57	57
Eastside Forests Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9	1.9	0.3	4.1	0.6	0.0	1.4	0.2	0.0	0.6	21	21
			5-9.9	42.7	32.3	54.0	2.2	1.0	3.6	0.0	0.0	0.1	39	39
			10+	58.3	51.6	65.3	19.2	16.4	22.0	5.3	4.1	6.5	117	117
		Cool	0-4.9	1.5	0.0	5.1	0.0	0.0	0.0	0.0	0.0	0.0	7	7
			5-9.9	48.7	30.1	70.0	7.3	3.1	12.2	0.9	0.0	2.4	18	18
			10+	84.3	69.4	100.3	24.4	18.8	30.4	6.0	4.0	8.2	38	38
		Cold	0-4.9	3.5	0.0	10.4	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	68.2	2.0	175.8	2.1	0.0	6.2	0.0	0.0	0.0	3	3
			10+	94.0	63.0	126.5	32.0	19.4	44.6	9.0	3.9	14.8	8	8
	PICO	All	0-4.9	0.4	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	34	34
			5-9.9	45.1	38.0	52.4	2.0	1.2	3.0	0.2	0.0	0.4	103	103
			10+	86.6	71.9	101.8	12.3	8.8	15.9	2.2	0.8	4.0	32	32

Table 4b continued: (document section 3.6, table 8b) Mean live tree density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for final snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Beaverhead-Deerlodge In Wilderness / Roadless	All Other Groups	Warm	0-4.9	9.5	0.0	19.1	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	26.8	7.5	50.7	4.6	0.0	10.8	0.6	0.0	2.3	5	5
			10+	75.6	62.7	88.8	29.1	22.6	36.0	10.8	7.5	14.4	35	35
		Cool	0-4.9										none	
			5-9.9	54.8	32.6	79.7	5.3	1.2	10.0	0.2	0.0	0.8	7	7
			10+	80.0	67.1	93.3	28.9	23.5	34.7	6.8	5.2	8.5	42	42
		Cold	0-4.9	1.3	0.0	4.0	1.3	0.0	4.0	0.0	0.0	0.0	3	3
			5-9.9	34.0	20.0	49.0	2.9	0.8	5.4	0.6	0.0	1.4	14	14
			10+	80.5	67.2	94.1	20.5	14.8	26.7	7.1	4.7	9.8	35	35
	PICO	All	0-4.9	4.6	0.0	12.1	0.0	0.0	0.0	0.0	0.0	0.0	4	4
			5-9.9	45.8	38.1	53.9	2.1	1.3	3.0	0.1	0.0	0.2	79	79
			10+	89.3	66.4	114.0	14.4	9.9	19.5	3.0	1.7	4.5	24	24
Beaverhead-Deerlodge Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9										none	
			5-9.9	57.1	34.2	82.7	3.2	0.7	6.2	0.0	0.0	0.0	10	10
			10+	60.6	50.1	71.4	18.0	14.0	22.4	6.3	4.2	8.7	42	42
		Cool	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	57.5	31.1	84.4	9.4	2.2	17.5	1.0	0.0	2.7	7	7
			10+	63.7	44.9	84.8	19.7	13.8	26.3	5.2	3.2	7.4	15	15
		Cold	0-4.9	10.4	0.0	20.7	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	11.9	0.0	27.1	0.0	0.0	0.0	0.0	0.0	0.0	2	2
			10+	88.5	36.6	163.0	15.3	4.2	28.0	2.8	0.0	6.8	3	3
	PICO	All	0-4.9	0.7	0.0	2.4	0.0	0.0	0.0	0.0	0.0	0.0	21	21
			5-9.9	47.9	39.5	56.8	2.1	1.0	3.4	0.1	0.0	0.3	62	62
			10+	78.8	62.2	96.1	12.5	8.8	16.5	2.0	0.3	4.2	20	20

Table 4b continued: (document section 3.6, table 8b) Mean live tree density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for final snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Custer In Wilderness / Roadless	All Other Groups	Warm	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	22.6	8.8	38.7	1.3	0.0	3.9	0.0	0.0	0.0	6	6
			10+	61.1	20.6	110.4	18.2	6.8	30.9	2.9	0.6	5.6	6	6
		Cool	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	2
			5-9.9	55.5	20.4	97.4	4.8	0.0	14.3	1.1	0.0	3.2	3	3
			10+	55.0	14.9	94.1	20.0	0.4	49.7	5.2	0.0	11.5	3	3
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	51.2	29.7	74.6	2.8	0.0	5.8	0.4	0.0	1.3	7	7
			10+	114.4	62.8	168.3	28.8	13.8	43.7	8.1	0.0	16.4	5	5
	PICO	All	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	24.8	5.6	45.0	3.9	0.0	11.0	0.0	0.0	0.0	4	4
			10+										none	
Custer Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9	2.3	0.0	5.0	0.5	0.0	1.5	0.2	0.0	0.8	16	16
			5-9.9	21.2	11.6	32.2	1.5	0.0	4.6	0.0	0.0	0.0	11	11
			10+	44.3	34.0	55.4	13.2	9.2	17.7	2.2	1.0	3.8	25	25
		Cool	0-4.9										none	
			5-9.9										none	
			10+	63.6	35.4	90.8	14.3	5.7	22.0	0.0	0.0	0.0	1	1
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9										none	
			10+	125.9	96.0	155.8	44.9	28.0	61.5	12.0	5.7	18.8	2	2
	PICO	All	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	41.3	0.0	86.8	5.6	0.0	17.1	0.0	0.0	0.0	3	3
			10+										none	

Table 4b continued: (document section 3.6, table 8b) Mean live tree density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for final snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound	Mean	90% CI-Lower Bound	90% CI - Upper Bound		
Gallatin In Wilderness / Roadless	All Other Groups	Warm	0-4.9	1.2	0.0	3.5	1.2	0.0	3.5	1.2	0.0	3.5	3	3
			5-9.9	24.6	11.7	41.6	2.4	0.0	5.4	0.0	0.0	0.0	8	8
			10+	67.3	45.8	91.4	24.8	17.9	32.0	6.7	3.3	10.6	14	14
		Cool	0-4.9	1.6	0.0	5.2	1.6	0.0	5.1	0.0	0.0	0.0	6	6
			5-9.9	50.4	28.9	73.6	7.8	3.2	13.1	1.2	0.0	2.5	10	10
			10+	89.4	77.4	101.7	31.0	25.7	36.5	9.3	6.7	12.1	43	43
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	5
			5-9.9	30.5	16.3	47.2	1.9	0.0	4.3	0.2	0.0	0.7	14	14
			10+	82.1	61.8	104.0	22.6	15.8	30.3	3.8	2.4	5.3	28	28
	PICO	All	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4	4
			5-9.9	55.5	35.4	77.6	2.2	0.5	4.5	0.0	0.0	0.0	17	17
			10+	97.9	66.7	132.7	12.7	7.8	18.2	1.7	0.6	3.2	16	16
Gallatin Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9										none	
			5-9.9	18.7	0.0	54.5	3.3	0.0	13.0	0.0	0.0	0.0	2	2
			10+	49.1	35.7	63.9	21.0	13.7	29.1	7.2	3.6	11.4	18	18
		Cool	0-4.9	5.1	0.0	20.4	0.0	0.0	0.0	0.0	0.0	0.0	2	2
			5-9.9	47.6	18.1	81.1	1.8	0.0	5.5	0.0	0.0	0.0	3	3
			10+	70.2	45.9	95.3	23.0	11.9	36.2	7.0	1.9	12.8	8	8
		Cold	0-4.9										none	
			5-9.9										none	
			10+	55.0	13.2	89.6	33.4	0.0	57.4	17.4	0.0	30.6	2	2
	PICO	All	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4	4
			5-9.9	39.4	6.0	78.0	3.5	0.0	7.7	0.8	0.0	3.2	8	8
			10+	56.8	33.4	81.6	23.6	11.6	36.6	6.3	0.4	12.9	5	5

Table 4b continued: (document section 3.6, table 8b) Mean live tree density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for final snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Helena In Wilderness / Roadless	All Other Groups	Warm	0-4.9	7.8	0.0	15.6	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	22.3	6.0	41.4	0.0	0.0	0.0	0.0	0.0	0.0	7	7
			10+	69.6	43.3	99.4	21.1	12.0	31.8	5.5	2.6	8.9	15	15
		Cool	0-4.9	3.5	0.0	6.9	3.5	0.0	6.9	3.5	0.0	6.9	1	1
			5-9.9	60.0	42.0	81.1	11.1	1.6	23.8	2.4	0.0	6.5	5	5
			10+	60.2	23.7	103.2	25.2	10.1	40.3	2.6	0.0	6.0	3	3
		Cold	0-4.9	14.1	0.0	28.2	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	38.1	19.5	57.9	1.6	0.0	4.4	0.0	0.0	0.0	7	7
			10+	63.4	20.5	112.2	8.0	0.0	16.1	1.8	0.0	7.0	2	2
	PICO	All	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9	9
			5-9.9	39.3	26.2	53.6	3.7	1.4	6.4	0.2	0.0	0.6	23	23
			10+	65.2	39.1	91.8	11.7	4.5	19.5	3.2	0.0	6.4	5	5
Helena Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9	1.9	0.0	7.4	1.9	0.0	7.4	0.0	0.0	0.0	2	2
			5-9.9	48.2	27.9	70.4	2.4	0.0	6.0	0.2	0.0	0.7	8	8
			10+	65.9	46.3	87.7	25.5	17.9	33.6	6.1	3.5	9.0	19	19
		Cool	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2	2
			5-9.9	92.9	0.0	229.1	11.6	0.0	34.4	0.0	0.0	0.0	2	2
			10+	118.1	68.4	173.3	31.5	11.9	56.2	8.0	1.2	15.4	7	7
		Cold	0-4.9										none	
			5-9.9										none	
			10+										none	
	PICO	All	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	44.0	25.9	64.3	0.9	0.0	2.3	0.2	0.0	0.8	14	14
			10+	176.2	126.6	231.5	2.8	0.0	11.3	0.0	0.0	0.0	2	2

Table 4b continued: (document section 3.6, table 8b) Mean live tree density per acre with 90% confidence interval, by diameter class, and seral stage (size class) for final snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups; in wilderness and roadless areas, for all eastside Forests and for each Forest.

Area	Dominance Group	Habitat Type Group	Seral Stage (Size Class)	Trees per Acre 10"+			Trees per Acre 15"+			Trees per Acre 20"+			Total Number PSUs	Number Forested PSUs
				Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Lewis & Clark In Wilderness / Roadless	All Other Groups	Warm	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10	10
			5-9.9	43.7	29.4	59.2	2.9	0.9	5.3	0.2	0.0	0.7	19	19
			10+	63.0	47.1	80.2	18.8	11.5	27.1	4.4	2.1	7.2	21	21
		Cool	0-4.9	0.5	0.0	1.9	0.5	0.0	1.9	0.0	0.0	0.0	16	16
			5-9.9	51.3	38.0	65.3	2.3	0.9	4.1	0.3	0.0	0.8	32	32
			10+	99.5	82.5	117.6	29.4	23.2	35.8	6.5	4.1	9.1	28	28
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	32.0	5.6	70.2	0.0	0.0	0.0	0.0	0.0	0.0	7	7
			10+	59.3	2.9	124.8	19.3	2.4	43.8	0.7	0.0	2.9	4	4
	PICO	All	0-4.9	0.3	0.0	1.0	0.3	0.0	1.0	0.0	0.0	0.0	15	15
			5-9.9	38.5	23.7	55.4	1.4	0.3	2.7	0.0	0.0	0.0	28	28
			10+	106.0	82.3	129.7	10.1	4.9	15.7	1.3	0.0	2.7	12	12
Lewis & Clark Outside Wilderness / Roadless	All Other Groups	Warm	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3	3
			5-9.9	54.7	25.8	87.8	1.5	0.0	4.1	0.0	0.0	0.0	8	8
			10+	79.1	53.6	106.1	22.6	11.6	34.9	3.9	1.6	6.5	13	13
		Cool	0-4.9										none	
			5-9.9	24.3	6.5	43.3	6.0	0.0	16.2	1.5	0.0	5.7	6	6
			10+	113.9	83.7	144.2	30.2	18.0	43.6	5.5	0.8	11.4	7	7
		Cold	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1	1
			5-9.9	180.9	121.3	249.5	6.2	0.0	12.4	0.0	0.0	0.0	1	1
			10+	124.5	84.2	168.1	53.4	38.0	67.0	4.8	1.0	8.8	1	1
	PICO	All	0-4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5	5
			5-9.9	38.8	20.1	59.6	1.5	0.0	3.4	0.0	0.0	0.0	16	16
			10+	111.4	75.8	147.9	3.7	0.0	8.3	0.0	0.0	0.0	5	5

Table 5: Snag densities for snag analysis groups: lodgepole pine dominance group (PICO) and all other dominance groups by habitat type groups, for all eastside Forests and for each Forest. Note: this table shows mean snag densities for the *entire* Forest.

Area	Dominance Group	Habitat Type Group	Snags per Acre 10"+			Snags per Acre 15"+			Snags per Acre 20"+			Total Number PSUs	Number Forested PSUs
			Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound	Mean	90% CI- Lower Bound	90% CI - Upper Bound		
Eastside Forests	All Other Groups	Warm	3.4	2.5	4.3	1.1	0.8	1.5	0.3	0.2	0.4	329	329
		Cool	16.6	14.0	19.2	3.9	3.1	4.7	1.0	0.7	1.3	264	264
		Cold	16.9	13.2	20.8	4.4	3.3	5.6	1.1	0.8	1.5	150	150
	PICO	All	7.2	5.7	8.8	1.3	0.9	1.7	0.1	0.1	0.2	412	412
Beaverhead-Deerlodge	All Other Groups	Warm	2.9	1.5	4.5	1.1	0.5	1.7	0.4	0.2	0.7	93	93
		Cool	14.6	10.5	19.1	2.8	1.8	4.0	0.5	0.2	0.8	74	74
		Cold	20.1	13.9	27.0	5.9	3.8	8.3	1.4	0.7	2.3	58	58
	PICO	All	3.4	2.3	4.6	0.6	0.3	1.0	0.1	0.0	0.1	210	210
Custer	All Other Groups	Warm	2.9	1.4	4.7	1.0	0.4	1.6	0.2	0.0	0.4	65	65
		Cool	20.6	5.0	42.0	7.8	1.2	15.5	1.1	0.0	2.5	9	9
		Cold	15.9	5.3	29.3	3.0	1.0	5.3	1.0	0.2	1.9	16	16
	PICO	All	9.3	1.7	18.5	3.9	0.0	10.5	0.6	0.0	1.8	11	11
Gallatin	All Other Groups	Warm	4.1	2.2	6.3	1.8	0.8	3.0	0.6	0.2	1.1	45	45
		Cool	25.3	19.4	31.6	6.7	4.8	8.8	1.9	1.1	2.8	72	72
		Cold	13.8	8.9	19.3	4.2	2.6	6.1	1.4	0.8	2.0	49	49
	PICO	All	12.9	8.4	18.1	3.0	1.4	4.9	0.2	0.0	0.7	54	54
Helena	All Other Groups	Warm	2.8	1.1	4.8	0.7	0.1	1.4	0.2	0.0	0.4	52	52
		Cool	14.3	7.8	21.7	3.0	1.0	5.5	1.1	0.3	2.2	20	20
		Cold	21.5	0.0	48.6	2.2	0.0	5.1	0.5	0.0	1.4	10	10
	PICO	All	7.9	3.9	12.7	0.4	0.0	1.0	0.0	0.0	0.1	56	56
Lewis & Clark	All Other Groups	Warm	4.2	2.0	6.9	1.2	0.4	2.2	0.1	0.0	0.3	74	74
		Cool	11.3	7.8	15.1	2.3	1.5	3.3	0.6	0.3	1.1	89	89
		Cold	12.9	4.1	24.6	2.4	0.4	4.8	0.0	0.0	0.0	17	17
	PICO	All	12.2	7.3	17.9	2.1	0.8	3.7	0.3	0.0	0.7	81	81

Appendix D: Dominance groups used in Snag Estimates

Following is documentation on how the Dominance groups of PICO and Non-PICO, used in deriving estimates for snag density were derived from Dom Group 60_40. Dom Group 60_40 is a mid-level dominance group based off of the R1 Existing Vegetation Classification System of dominance type 60_40. Dom Group 60_40 is the same classification used when developing R1-VMap for eastside Forests. For further information on how dominance type 60_40 is classified from inventory data, see *Region One Vegetation Council Existing Forested Vegetation Classification System and Adaptation to Inventory and Mapping* (Berglund and others 2008). This dominance group is available through various reports supported by Region 1 and available through the R1 Report Depot (http://fsweb.r1.fs.fed.us/forest/inv/fsveg/index.htm).

Dom_Group_60_40	Snag Analysis Dominance groups
none	All Other Group
ABGR	All Other Group
ABGR-IMIX	All Other Group
ABGR-TMIX	All Other Group
ABLA	All Other Group
ABLA-IMIX	All Other Group
ABLA-TMIX	All Other Group
BEPA	All Other Group
BEPA-IMIX	All Other Group
BEPA-TMIX	All Other Group
IMIX	All Other Group
JUNIP	All Other Group
JUNIP-IMIX	All Other Group
JUNIP-TIMIX	All Other Group
LALY	All Other Group
LALY-IMIX	All Other Group
LALY-TMIX	All Other Group
LAOC	All Other Group
LAOC-IMIX	All Other Group
LAOC-TMIX	All Other Group
PIAL	All Other Group
PIAL-IMIX	All Other Group
PIAL-TMIX	All Other Group
PICO	PICO
PICO-IMIX	PICO
PICO-TMIX	PICO
PIEN	All Other Group
PIEN-IMIX	All Other Group
PIEN-TMIX	All Other Group

Dom_Group_60_40	Snag Analysis Dominance groups
PIFL2	All Other Group
PIFL2-IMIX	All Other Group
PIFL2-TMIX	All Other Group
PIMO3	All Other Group
PIMO3-IMIX	All Other Group
PIMO3-TMIX	All Other Group
PIPO	All Other Group
PIPO-IMIX	All Other Group
PIPO-TMIX	All Other Group
POPUL	All Other Group
POPUL-IMIX	All Other Group
POPUL-TMIX	All Other Group
POTR5	All Other Group
POTR5-IMIX	All Other Group
POTR5-TMIX	All Other Group
PSME	All Other Group
PSME-IMIX	All Other Group
PSME-TMIX	All Other Group
TMIX	All Other Group
THPL	All Other Group
THPL-IMIX	All Other Group
THPL-TMIX	All Other Group
TSHE	All Other Group
TSHE-IMIX	All Other Group
TSHE-TMIX	All Other Group
TSME	All Other Group
TSME-IMIX	All Other Group
TSME-TMIX	All Other Group

Appendix E: Regional Disturbance Statistics for 2000-2007 and Harvest Acres from 1950-2007

Report compiled May 20, 2008

Average harvest acres 2000-2007 (FACTS)

- The Region has harvested approximately 24,312 acres per year**,** over the past 8 years.
- 12% even-aged (5% of even-aged is clearcutting), 26% 2-aged, 3% selection harvest, and 59% intermediate harvest (commercial thinning, etc.)
- Statistics do not include pre-commercial thinning

Average Pre-Commercial Thinning and Release acres 2000-2007 (FACTS):

- The Region has pre-commercially thinned and released approximately 10,269 acres per year.

Average prescribed burning 2000-2007 (NFPORS):

- Over the past 8years approximately 44,000 acres of prescribed burning has been completed on the average each year.

Average number of acres burned in wildfire/fire use 2000-2007 (fire history layer):

- Approximately **273,000 acres**/year are burned on National Forest Systems land in Region 1.
- In 2007, for the fires over 1,000 acres, 35% of the acres were low severity, 15% of the acres were mixed severity, and 50% of the acres were high severity (from RAVG 2007).

Average number of acres with bark beetle mortality 2000-2007 (I and D detection flights):

- At least 625,000 acres/year or about 5 million acres in total have some form of mortality due to bark beetles.
- Some of these areas were visited multiple years by beetles. When multiple year mortality is included for the same acres, the total cumulative acres with beetle mortality is 12 million acres or 1.5 million acres a year. Therefore, over the eight years, the *severity* of infestation on the 5 million base acres affected, increases as the infestation progresses through time.

Information Sources:
FACTS: Forest Service Activity Tracking System, which records tabular information in an electronic database, and records, associated spatial polygons in a GIS system, for activities accomplished on an annual basis. This system houses the information for annual accomplishments reports for Congress as an accountability measure related to Forest Service budget allocations in areas of silvicultural practices, such as planting, thinning, timber harvest, and fuels activities by fund code. It also includes noxious weed treatment accomplishments and many other activities funded by KV dollars contained in Sale Area Betterment Plans.

NFPORS: National Fire Plan Operations Reporting System is an interagency fuels treatment accomplishment data base that is interagency by design that was developed to report to congress on fuels accomplishments on an annual basis. The Forest Service's fuels activities are loaded

into FACTS then electronically moved into NFPORS as part of the interagency system. NFPORS does not contain spatial information but does contain latitude and longitude, which locates the center of a project accomplishment on a map.

Fire History Layer: is a Region 1 spatial database, which has a polygon layer of fire perimeters gathered from incident command teams for each fire, by fiscal year.

Aerial Detection Survey: Flights completed each year across the northern Region to document the outbreaks of various insect infestations. The region is flown in a grid and insect and disease mortality is mapped through direct observation from the air. Not all areas of the region are flown every year and information is documented on areas flown and areas not observed. Weather and smoke are some factors related to areas not surveyed in a particular year. This map information is converted to GIS and can be used to track the progression of outbreaks over a time span.

RAVG: is a remote sensing product that is completed to determine fire severity for large fires over 1,000 acres each year. This is completed by the Remote Sensing Applications lab located in Salt Lake City, UT. This characterization of fire severity on vegetation is completed within 30 days of fire containment and can be used to determine some of the resource effects from the fires.